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THE WAR.

That the immediate effect of the war upon the planting industry will be one of depression seems inevitable from the fact that the purchasing power of at least two continental countries, namely Germany and Austro-Hungary, whose markets have hitherto taken a large proportion of our produce, must suffer diminution from the ruin, partial or complete, which will in all probability overtake many commercial firms, manufacturers, bankers and ship-owners within them owing to the cessation during the war of most of their foreign trade. A diminished purchasing power involves reduced consumption and demand with consequent lower prices. The diversion of trade to other countries, which no doubt will take place to a large extent, will not in our belief suffice to neutralize the effect of the crippling of the markets of a hundred and twenty millions of some of the world's most industrial peoples. The drain of the war may be expected to have its effect also upon the purchasing power of the Allies, at least for a short time.

Cane sugar will probably prove a notable exception to other tropical products and enjoy good prices what time the continental beet fields lie fallow. Dye stuffs may also experience a spurt till British manufacturers can arrange to supply synthetic dyes hitherto largely manufactured in Germany.

With the waste of war repaired a revival will no doubt set in. The burden of armaments will be relieved and millions of pounds now expended in the production of weapons of war will be released for the arts of peace. Some of those millions will

certainly come our way, and happily few of our products are required in the manufacture of war material. The war has revealed in a significant manner how completely dependent we seem to be, almost from day to day, upon the European manufacturer with regard to many of our products, such as copra, which cannot be stored for long. Again, we have not yet succeeded in producing a staple food for man or beast in temperate climes, and consequently the tropics have been unable to come forward with offers of food for the troops. We have a great number of cereals and pulses, but they are all raised by manual labour and therefore cannot very well compete with farm crops handled by machinery from first to last.

A correspondent, Mr. K. Bandara Beddewela, in applying for some slips of cluster sweet potatoes for distribution among poor villagers whom he is inducing to raise further food supplies, points out the importance of the people raising quickly yielding food stuffs as a provision against unemployment which already is beginning to be felt. Members of the Ceylon Agricultural Society will, it is hoped, follow our correspondent's example and make it their special task to encourage their poorer neighbours to plant up their gardens with sweet potatoes, yams, manioc, Indian corn, peas and beans, pumpkins, millet and other food products. It is a direction in which each member can serve his country and the Empire. If seed is required members could inform instructors, who are devoting special attention to this subject, or apply direct to the Society, which will obtain it for them at cost price. When the paddy crop now being sown comes to be harvested members should make a special point of impressing upon cultivators the importance of laying by their seed paddy and not touching it whatever may occur. Co-operative Credit Societies have a great opportunity here of proving their value to the country by looking after the interests of their members in the matter of seed and encouraging them to be provident and plant their gardens.

We will conclude with a word about ourselves. Advertisements of enemy subjects are discontinued, and we can no longer circulate the Tropical Agriculturist in enemy countries. This means a serious falling off of revenue which we are meeting by cutting down the size of the Journal by two folios (16 pages). We ask the indulgence of our readers till good times come again.

R. N. L.

RUBBER.

PLANTATION RUBBER FROM A MANUFACTURER'S POINT OF VIEW.

W. A. WILLIAMS.

So much has been written and expressed upon the uses of plantation rubber in the manufacturing industry, that practically nothing remains upon which to give an opinion. The points, for and against, have been expounded until both planters and manufacturers know the arguments off by heart.

The only excuse I have to offer for bringing forward the subject is, that the use of plantation rubber is of paramount importance to both planters and manufacturers, and the exhibition is a fitting opportunity for pointing out, to our friends the planters, the experience gained by using large quantities, especially during the last few years, and for making suggestions which, in my opinion, will foster the employment of still larger quantities in future.

In the employment of plantation rubber in the factory the manufacturer has, first of all, to settle upon the class of rubber he will use, and on this heading alone much difference of opinion has existed. To my mind the adoption of an unsuitable class has, in many cases, been the cause of complaint and condemnation of plantation rubber.

It is to be understood that only first quality latex is entering into consideration, and at the outset the user has to decide as to whether he will use :

1. Unsmoked biscuit or sheet.
2. Smoked biscuit or sheet.
3. Creped rubber.

My experience of the above is that for all round results the unsmoked biscuit, or sheet, is to be recommended for the reasons that, for average strength and uniformity, it is as good as smoked, and for strength it is, undoubtedly, superior to crepe.

The disadvantages of smoked are :

1. Increased washing and drying loss,
2. Increased resin content,

the latter being especially undesirable when manufacturing against specification.

The usual method of preparation of smoked sheet, producing as it does a rubber with merely a surface smoking, is one which it is difficult to understand should recommend itself to manufacturers, and it appeals to reason that, where the smoking operation is only superficial, little if any advantage can be obtained by subjecting the coagulated rubber to this process. If smoked rubber is to offer any advantage in the manufacturing industry, I am confident this can only be obtained by the smoking process being so arranged that the product is uniformly treated throughout. Then it is possible that smoked plantation might offer some additional advantages in the manufacturing industry. At present my experience is that there is nothing to gain by adopting this grade.

On the question of crepe, I am afraid the planters have sacrificed every thing to appearance, the whole object, apparently, being to obtain a nicely finished product. It is obvious that no advantage is to be gained by having the nerve destroyed by the creping rollers, which must, inevitably, be the result of this process. The manufacturer is not interested in the pretty appearance of the rubber as delivered to his factory. What he wants are results in his manufactured products—strength and reliability. Further, my experience is that, with the use of creped rubbers, vulcanisation difficulties are greatly increased. Their use has been, I fancy, the cause of many adverse comments upon the employment of plantation rubber generally.

I think it will be recognised that the quality of rubber cannot be judged by appearance, or the value for manufacture by hand-pulling. Samples which, if judged by these tests, would be considered superior to those of spotty appearance and general bad colour, have, on manufacture, proved to be much inferior ; so why should so much thought be expended upon obtaining a pretty appearance, which is of no interest whatsoever to the manufacturer ?

When the class of plantation rubber is fixed on, unfortunately our difficulties of manufacture are not disposed of, but, perhaps, the greatest difficulty of all has now to be faced, namely, its variability ; and although, as stated above, I consider unsmoked biscuit, or sheet, to be the most desirable all round, this question of variability enters into all classes of plantation rubber. Owing to this variation its successful manufacture can only be accomplished by organising strict scientific control in the factory.

The practice in operation at the works of The North British Rubber Company, Ltd., is the careful testing, by the laboratories of all deliveries before the crude enters into manufacture, by which means any necessary assortment is made.

The properties of the crude rubber coming forward to the manufacturing departments are so indicated in advance, and one of the greatest difficulties in the employment of this grade of rubber is adjusted, namely, that of vulcanisation.

My experience is that, outside all questions of strength, the question of the vulcanising properties of plantation rubber is the greatest trouble the manufacturer has to face. Without efficient control, faulty vulcanisation undoubtedly will be responsible for much loss of time and money. These troubles, in factories where scientific control is not thoroughly organised, may be sufficient to condemn the use of this grade entirely.

It is, therefore, to the interest of the plantation industry, just as much as to that of the manufacturer, to have these troubles—if not entirely eliminated, which is, perhaps, impossible—at least reduced to a minimum, and thus bring about a condition of affairs which cannot be said to exist at present.

One appreciates the fact that some factors which possibly influence this are outside the control of the estate management, such as the variation of climate and soil, and, at the present time, the age of trees ; but, on the other hand, much is under control, namely, the method of tapping and coagulation. These are matters quite outside the writer's province and experience, as to the best methods to be adopted, but are so crucial to the industry that I believe advice, and steps, will be taken to obtain uniformity of method on the estates, so far as is practicable.

It is to be hoped that any experimental work taken in hand by the plantation industry will be conducted conjointly with the manufacturers, as the best and quickest results, and the placing on the market of a plantation rubber most suitable for consumption are only to be achieved by working together, and not as two separate industries.

Our interests are in common and not antagonistic, the object being the production of a plantation rubber which will give uniform results in the factory, and reliability in use, thereby ensuring greater confidence in the employment of this grade of rubber, and consequent greater consumption.—Handbook, 1914 Rubber Exhibition.

RUBBER AT GANGORUWA.

The Tephrosia candida in both the hill-side and hill-top plantations of Hevea is being cut and mulched to the trees to carry them through dry September. This is the fifth cutting since June 1913, when the seed was sown 2 × 2 feet, 6 lb. per acre. It was last cut on June 9th and is now 2½ feet high, and is being cut back to one foot from the ground, i.e., it should be cut every 10 weeks at most or it becomes too woody—increasing the labour of cutting, tearing the stems, and being bulky to mulch. A piece of 50 yards square has yielded 3,285 lb. of green stuff.

All the supplies are coming on well.

Plots 73—76 of young Hevea have been thoroughly cleaned and disc-harrowed, the trees being well mulched with Crotalaria and jungle green stuff. The bank of this plot by the main road has been levelled and turfed.

Plot 140 B, the Tephrosia candida not having germinated well, Leucæna glauca has been sown from freshly-gathered seed which germinates at once. An experiment is being carried out on the germinating periods of Leucæna glauca.—Progress Report, Experiment Station, Peradeniya.

THE RATIONALE OF RUBBER GOODS MANUFACTURE.

DR. JOSEPH TORREY.

The one word the public knows is "rubber," and the term "pure rubber" flits airily in and out in a way that indicates, pretty clearly, the general belief that rubber goods should consist of rubber and little or nothing else. The frequent mention of "percentage of rubber" indicates a prevalent belief that the merit of goods is proportional to the rubber they contain. It will, therefore, be both interesting and profitable to take a survey of the facts underlying modern rubber goods manufacture.

First of all, rubber is one of those substances whose commercial usefulness is very largely determined by the presence in it of certain foreign substances or "impurities." It is pretty well understood that all rubber goods have to be vulcanised, and that, without vulcanisation, rubber goods

would be of no use. Now, it is very doubtful, in the light of recent investigations, whether absolutely pure rubber will vulcanise in a manner which would meet requirements. Certain it is that the further the purification is pushed, the more sluggish the vulcanisation becomes.

All natural rubbers contain resinoid bodies in varying amounts, together with small quantities of nitrogenous bodies known as *proteids*, and it is certain that these substances, even in the very small amounts present, have a very great influence in determining the fundamental and essential properties which make rubber commercially useful. Here, then, we have quite a close parallel with iron.

Coming now to the manufacture of rubber goods, we encounter a somewhat similar order of facts. It is not at all practicable to make goods from nothing but vulcanised rubber, no matter what may be the price of it. It might be practicable in, say, ten per cent. of them, i.e., in some special cases where all that is required is a very high degree of extensibility and elasticity, as in rubber bands, "dental dam," etc., but the great bulk of rubber goods are subjected to far more severe conditions of service and must be equipped to meet them. They must resist strain, shock, wear, identation, etc. It may be, also, that there are conditions of service which are constantly tending to deteriorate and wear out the resisting power. In a cycle or motor tyre we have the air pressure and the strong heating action that shows itself when a tyre is run at high speed. In case of hose we may have the effect of steam, hot or cold water, or even acid or alkaline solutions. Oils or greases are another source of danger, and last, but not least, we have the insidious action of rain, wind and sunlight.

Rubber by itself, even though vulcanised, is poorly equipped for such an ordeal. It must be properly armoured and strengthened for its tasks—and this is accomplished by mixing with it certain substances, mostly arrived at through experience.

Let us see what some of these are and how they are used.

First in order come certain substances which tend to increase strength and resilience. Oxide of zinc is the most conspicuous of these, though in these days *lithopone*, which is a mixture of zinc sulphide and barium sulphate, is more common. Calcined magnesia has the same effect, and, what is fully as important, all these tend to make the vulcanising process proceed more promptly and sharply. In a great many cases—notably that where the goods are vulcanised in a press mould—this is a very important point, for it tends to insure sound goods and save time as well. Small quantities of lime, litharge or white lead are sometimes added to accelerate the vulcanisation.

At this point it is worth noting that the addition of these various mineral powders to the rubber was not originally done with the idea of making it stronger or more elastic. The practice is older than the vulcanising process, and the object was to make the rubber less sticky. After the discovery of vulcanisation this necessity did not exist, for vulcanised rubber is not sticky; but it soon appeared that the mineral powders had very decided effects upon the vulcanised product and, moreover, as the price of rubber advanced, the cheapening effect of these additions began to be of importance. It is quite a common belief, on the part of the non-technical

public, that the main object of these additions is to cheapen the product, but this is a great mistake. No matter how cheap rubber may become in the future, it will always be necessary to pursue, practically, the methods we do at present, if the goods manufactured are to be of any service.

The same necessity exists for the addition of a second group of substances, which act as protectors against atmospheric agencies—sun, wind, rain, etc.—or perhaps against water, either cold or hot, steam or even acids or alkalies. As examples where this kind of protection is required may be cited garden hose, pump valves, packing, steam or water hose, air-brake hose and hose used in chemical works. In general, too, any article that has an out-of-door life must be fortified, as perfectly as possible, against that most insidious foe of rubber goods—sunlight.

The idea involved here is nothing peculiar to the rubber industry. We impregnate wood with creosote, oil and other substances because it protects the wood against decay and keeps worms at bay. We impregnate rope with tar to make it stand weather better. Leather is doubly fortified—first by the tannin process, which bears about the same relation to the leather business that vulcanisation does to the rubber business—that is, in its commanding importance. The tanned leather is further protected by impregnation with oil.

In case of rubber we select out protectors with regard to the kind of protection needed. The best principle to go on in protecting against the action of water is to render the valve, or hose tube, as nearly waterproof as possible. People are accustomed to regard rubber as being waterproof itself, but there is no denying that it is penetrated by water when it is long in contact with it, and it is certain that, by mixing with it small quantities of substances which tend to resist water—such as heavy tar, or petroleum jelly (vaseline)—the goods resist water much better. It is, of course, important that good judgment be used both as to the quality and the quantity of the oils or tars used.

Sometimes, on the other hand, it is necessary to fortify our finished article against the action of oil. In this case it is necessary to incorporate some substance that tends to resist oil. Glycerine is often used for this purpose, but usually not alone. It is rubbed up with lead oxide, or zinc oxide, when it forms a plastic soap, which is then worked into the rubber mixing before it is vulcanised.

When the object is to resist the action of acids, we have two possible methods: we may either try to make the mixing waterproof (since most acids are in water solution) or we may incorporate some mineral powder which is not acted upon by acids, trusting to the rubber being "covered" or protected by the acid-proof powder. Often it is well to combine the two methods.

Articles that have to stand not only wear, distortion, shock, etc., but the action of atmospheric agencies as well, present a very difficult problem. The thing to be guarded against here is oxidation—to which rubber is comparatively sensitive. We begin by trying to arrange matters so that whatever action there is shall be confined to the outer surface of the article, and thus produce the minimum of effect. Great care is taken with the vulcanisation for the following reason: As has already been explained,

vulcanisation consists in adding to the mixing a determined quantity (a few per cent.) of sulphur, and heating to the appropriate temperature for a certain time, known by experience, to produce the desired result. Now, part of the sulphur remains in the mixing unchanged after the heating, and when the article is exposed to the weather for a while the "free sulphur" at the outer surface is gradually eliminated, partly mechanically and partly chemically. Then a sort of diffusion of "free sulphur" from the interior to the surface takes place, and on reaching the surface it is eliminated as before. The result of this gradual elimination is that the article is left porous, i.e., minute cavities exist where the sulphur was, and these present just so much more surface for the action of oxidising agencies. We endeavour to meet this difficulty by so vulcanising that the smallest possible amount of free sulphur is left after the vulcanisation. Then again, mineral powders which are not oxidisable, and some of the less oxidisable oils, or waxes, are useful in the same way as in cases already discussed.

This problem of durability, however, is very difficult at best so long as we confine ourselves to the use of rubber and such substances as have been mentioned.

The so-called "reclaimed rubbers" are exceedingly useful here.

The name by which these products are known is misleading, and the same is true of the alternative terms "recovered rubber" "regenerated rubber," etc. They are misleading because there is no process known to-day by which pure unmixed rubber is recovered from "waste rubber" or "scrap rubber" by which is meant either factory scrap or goods which have been thrown aside sometimes on account of defective manufacture, sometimes because they have worn out in service, and sometimes on account of accident or injury which has rendered them unfit for further service.

The quantity of scrap rubber accumulated during the year is very large. There is no way of determining it exactly at present.

For many years attempts have been made to render it available for use in the manufacture of new goods, with very satisfactory results. The processes are very simple. Whatever canvas or fabric the goods may contain is first eliminated, sometimes mechanically, sometimes chemically. Next, the "free sulphur" is dissolved out, usually by the action of hot caustric soda, and the product, which represents the mixing originally used in manufacture, is washed, dried and carefully milled. If the process is skilfully conducted, the product shows a very large percentage of its original merit and can be vulcanised as easily as it was in the first instance. The especial feature of these products is their great power of resisting atmospheric influences. There is no mixing made from pure rubber, and the usual mineral additions, which can approach a good reclaimed rubber when the conditions of service require long periods of exposure to sun, wind and rain, in addition to this usual service wear and tear.

Last of all come a curious class of materials known as the "rubber substitutes"—another unfortunate term. Their existence depends upon the fact that certain vegetable oils, when boiled with sulphur, or when mixed with chloride of sulphur, show a species of vulcanisation and are converted into a more or less elastic jelly. Their use has often been made the subject of severe criticism, and there is no doubt that they require a degree of

intelligence and skill in their use which is often lacking. Nevertheless, the enormous quantities that are used, during the year, show that they have a field of usefulness, and those who have had the best opportunities for observing their behaviour know that, when intelligently used—they are not only unobjectionable but useful.

Nothing has been said thus far about the various pigments used to impart to rubber goods the colours which a not very discriminating public demands. It would be better if no colouring was ever done, but it is and probably will be for some time. Details are of little interest here. The colouring matters are usually coloured powders of such a nature that the colour is not altered by the vulcanisation process.

To sum up :—

1. Rubber goods contain a large percentage of materials other than rubber.

These materials, being almost always cheaper than rubber, tend to make the product cheaper, but this is not the whole object of using them.

3. Some things are added because they enable the vulcanised product to stand mechanical strain, shock or wear more efficiently.

4. Others are added because they constitute a species of protective armour, enabling the product to endure special chemical action to which it may be exposed in service, or to resist deteriorating influence of outdoor service, i.e., wind, rain and sunlight.—Handbook of the 1914 Rubber Exhibition.

INTERNATIONAL RUBBER AND ALLIED PRODUCTS EXHIBITION.

This Exhibition was opened on June 24th last at the Agricultural Hall, London, and was attended by the Director of Agriculture, as Commissioner for Ceylon, and a goodly number of visitors from the Island, who were welcomed by the President of the Exhibition, Sir Henry Blake, who, it may be mentioned incidentally, is the founder of the Ceylon Agricultural Society.

The Society contributed a sum of Rs. 250/- towards the expenses, and the exhibits from Ceylon consisted chiefly of rubber, coconut products, spices and fibres. Reports so far received indicate that the Colony occupied a high place among the fifty-four Governments that took part in this international display, and that its produce secured a number of well-merited awards.

C. A. S. REPORT.

ERRATA.

In last issue on page 201, *Morynga koenigii* should be *Murraya koenigii*, and on page 233 for *Trichosanthies* read *Trichosanthes*, for *Deshcen: Dasheen*, for *Golocasia: Colocasia*, and for *Pennisotum: Penniselum*.

COCONUTS.

THE TREATMENT AND MANURING OF THE COCONUT PALM.

M. KELWAY BAMBER.

(*Continued from page 195*)

APPLICATION OF MANURES.

This is usually done by digging circular shallow trenches round the palms, forking the manure into the trench and covering with soil. The distance of the trench from the palm varies, some putting the manure at 3 feet—4 feet or even closer, and others up to 10 feet—12 feet.

It is generally believed that most absorbent rootlets are to be found where the drip of rain water from the leaves would fall on the soil. In the case of the coconut palm much of the rain that falls on the top upright leaves is directed inwards to the crown and runs down the stem. As a constant supply of moisture is essential for the solution of the manure, and most of the absorption is from the root extremities about 8 feet to 12 feet would be the best distance for large well grown palms. For young palms and those of stunted growth, a closer application is advisable, from 3 feet to 4 feet gradually increasing the distance as the palms increase in vigour and the spread of leaf becomes greater. An experiment with a 7 year old palm with a large proportion of upright leaves showed that 97 per cent. of the rain ran down the stem, 0·3 per cent. from 2 feet—6 feet, and 2·7 per cent. from 8 feet to 12 feet from the stem.

For the improvement of a backward estate which has been more or less neglected for years, it is advisable before manuring thoroughly to plough or cultivate the whole soil, or large circles round the palms, burning all refuse dead leaves, etc., and spreading the ash over the loosened soil. A few months later when the palms have begun to form fresh rootlet, manure should be applied in six inch deep trenches at 3 feet to 6 feet from the stems and forked in with any decaying weeds cheddy or available organic matter, and the trench filled with soil.

All coconut husks and newly fallen leaves should be laid over this forked area to retain moisture round the manure and so encourage root growth into it.

On most estates the amount of organic matter available for mulching purposes is comparatively small, and humus can only be added in quantity by growing a green manure. For this purpose there are several suitable plants including two or three varieties of Tephrosia and Crotalaria. The Tephrosia commonly found in the Low-country generally and on several estates are Tephrosia purpurea (Pila) with straight and narrow pods, and another variety with curved hairy pods, also a creeping variety which is to be found in the North-Central Province. Either of these grow freely forming small

bushy plants about 18 in. high, the leaves being very rich in nitrogen containing about 2·5 per cent. on the dry material, and as a rule the seed can be collected with very little trouble and expense. An important variety is Tephrosia candida, which is larger and more robust, giving as much as 40 to 50 tons of green material annually for 3 or 4 years. It grows well on rubber and tea estates, and is now being tried on the sandy and cabooky soils of coconut estates. Crotalaria striata and incana also Cajanus indicus or the Pigeon pea are also very useful, the latter supplying a certain amount of fodder for cattle and an edible grain.

Such green manures should be sown in from 2 feet to 5 feet wide rows between the palms, and when 4 feet to 5 feet high, the plants should be cut across at 15 in. and the material mulched over the forked ring where the manure has been applied. The leguminous green manures average 0·86 per cent. of nitrogen on the fresh plant, a ton containing 19½ lb. of nitrogen, and many tons can be grown per acre.

A well grown green manure plot should supply far more nitrogen than the palms require annually; but while growing they absorb a large amount of mineral matter, especially lime, potash, and phosphoric acid from the soil, and therefore are competing with the palms. This is given back when the green material decays, and reverts to humus, but it is advisable to apply additional phosphoric acid and potash when a green manure is being grown.

The effect of green manures is permanently to improve the soil conditions for bacterial growth, and to enhance the effect of artificial manures by increasing the humus and water retaining power of the soil. On sloping soils they also greatly assist in preventing wash of surface soil.

Good drainage is essential for all soils, but the presence of ample moisture is of more importance even than manure, as no amount of the latter can counteract the immediate and after effects of a long drought. It is estimated that a well grown palm transpires through the leaves about 2,235 gallons or practically 10 tons annually; allowing for 70 palms per acre, this equals about 700 tons, or the equivalent of 7 inches of rainfall per acre. Every planter knows the heavy fall of immature nuts that succeeds a drought, especially after the first shower of rain, and the loss in crop that results.

Any practical means of preventing this loss by irrigation, dry farming, and increasing the humus would materially increase the yields per acre. Irrigation is in many cases out of the question, but much may be done by dry farming and increasing the humus. In the Peradeniya experiments, ploughing the soil twice annually had a very marked effect on the old palms, and the younger palms were also greatly benefited by stirring the soil monthly with a disc harrow. At Maha-illuppalama in the dry zone the effect is even more marked, the growth of the palms being very fine as the results of the cultivation with disc harrows. These latter experiments have demonstrated the value of irrigable land in the N.C.P. for coconut cultivation and show that far less water is required than for paddy, when a thorough system of surface cultivation is adopted.

In all the districts where rainfall is deficient stirring the surface soil should be done at the beginning of the dry weather to form a loose mulch, which will prevent evaporation of the subsoil moisture. This together with mulching of the manured rings will greatly assist the palm in withstanding drought, but the treatment must be continued over several years.

Much useful work has already been done in the manuring of coconuts by private owners and others, and the manure merchants have greatly assisted proprietors by the excellent booklets published on the composition and value of certain manures, and the results of manuring already obtained. It is unnecessary to enumerate all the manures that are now available for coconut cultivation, as most of them are well known to you, but a few words as to their properties and suitability for various soils may be advisable.

The chief phosphatic manures employed are Bones, steamed or ground. Basic slag and superphosphates. Steamed and ordinary bones contain at least 3 per cent. nitrogen and 22 per cent. phosphoric acid, equal to 48 per cent. phosphate of lime. They decompose slowly in the soil; but the successful results obtained from their use show that coconut roots attack them rapidly. There is no fear of loss of phosphoric acid by their use.

Basic Slag has no nitrogen, but contains 15·20 per cent. of free lime and 20 per cent. of phosphoric acid in a form easily available to the palms. It can be used with advantage in soils poor in lime and phosphoric acid, especially in conjunction with green manuring. On pure sands without green manures, the lime would be better applied as ground coral lime.

Superphosphate consists of bone or other phosphates which have been treated with sulphuric acid to render the phosphoric acid soluble. Ordinary superphosphate contains no nitrogen, but 18 per cent. phosphoric acid and a good proportion of sulphate of lime, which as I have said, may be of special value to the growth of the palm. It is suitable for application to all the soils, but when poor in lime, they should receive an application of ground or slaked coral lime previous to the manuring.

Of the potash salts, the muriate contains 58 per cent. pure potash, compared with 50 per cent. in the sulphate, both costing the same. For soils poor in sulphuric acid, and most of them are, the sulphate is probably better. It is soluble in water and after rain would soon be diffused throughout the soil.

Kainit is another potash salt frequently employed. It contains only 12 per cent. potash, but a considerable amount of salt and some magnesium salts. These are very hygroscopic and are thought to assist in absorption of atmospheric moisture during a dry period. A pound of potash costs 50 per cent. more than the potash in the muriate or sulphate.

If mixed with basic slag as is commonly done, it should be applied at once, or kept in a dry place, otherwise the slag will set like cement and be rendered useless.

NITROGENOUS MANURES.

These consist of the organic manures such as cakes, blood, and fish, and for this reason are valuable on soils poor in humus. The nitrogen is insoluble in water, but as the manures decompose, it is gradually converted into ammonia and nitric acid which combines with lime, and can then be absorbed by the roots, chiefly as nitrate of lime.

The cost of nitrogen per pound varies, but Groundnut Cake is the cheaper at 70 cts. and Rape Cake the most expensive at 92 cents.

Blood Meals contain from 11 to 12½ per cent. of nitrogen and are more rapidly decomposed than cakes, but the pound of nitrogen costs more than in Groundnut Cake.

The Nitrates are all very soluble in water and have to be used with caution. They should not be applied during or just before the wet season, otherwise some loss is bound to result, but a certain amount can frequently be employed in mixtures with advantage. The cheapest source of nitrogen available at present is in Nitrolim, which is a manure formed from the nitrogen of the air. It contains from 20 to 24 per cent. of free lime and 18 per cent. of nitrogen, and has a strongly alkaline reaction like basic slag, making it very suitable for acid soils. It has been very successfully employed for tea and rubber. For coconuts there is no reason why it should not be equally valuable especially on estates where green manuring is carried out systematically. It cannot be used in mixtures containing blood meal or ammonia salts, unless added just before application.

I have not gone into the details of various mixtures suitable for manures, as so much depends on the soil, local climatic conditions, and the condition of the palms when manuring is to be undertaken. Manuring may not always be necessary, and in some cases would be distinctly wasteful unless efficient drainage, and cultivation of the soil is done prior to the application.

The main points to be borne in mind when manuring Coconuts are first to apply a manure suitable to the soil requirements, and of a composition that will encourage a healthy and vigorous leaf and root development. Then when this is accomplished to apply a manure richer in potash and phosphoric acid to further encourage fruit production and of a superior quality. Thirdly to apply the manure at sufficiently short intervals to insure continuous growth and minimise the effect of drought on yield and quality of the nut. Samples of copra from manured and unmanured palms have been shown me which clearly demonstrate the beneficial effects of manure on the appearance and thickness of the meat, and no doubt on the oil contents.

No trees respond more to proper manuring than the coconut palm, especially in the younger stages, but even palms of 70 to 80 years of age will respond as shown by the results of the Peradeniya experiments, which have now been conducted for three and half years.

The chief difficulty to be overcome in the improvement of such old palms, of which there must be many thousands of acres in Ceylon, is to enable them to retain the large proportion of nuts, which form as the result of the manuring or cultivation, but which fall at all stages from an inch in diameter to nearly half grown, but chiefly in the younger stages. The average yield of ripe nuts from the manured and unmanured plots since the experiments began were:

	1911	1912	1913
Manured	26·8	33·0	30·9
Unmanured ...	27·4	24·2	23·0

while the immature nuts were for the same period:

	1911	1912	1913
Manured	23·5	41·6	49·0
Unmanured	36·3	42·4	45·7

Had it been possible for the palms to retain these nuts, or even half of them the results would have been very satisfactory. It is probable that careful supporting of the flowering stalks would have saved many, but it is difficult to carry out on tall trees of this age.

An encouraging feature in these experiments, especially for the smaller cultivators who cannot easily afford expensive manures, is that ploughing or digging or the growth of leguminous plants with the aid of the cheaper mineral manures as Basic Slag and potash, or mulching with any weeds or cheddy, all have a good effect on the palms, and increase the yield considerably. Such treatment is within the reach of every one, and should well repay the extra trouble and slight expense incurred.

FLOWERING OF THE COCONUT.

Little had been recorded of the life history or biology of the flower of the coconut until MR. PETCH, the Government Botanist and Mycologist, studied the subject and published a paper in the TROPICAL AGRICULTURIST.

The impression among many coconut planters was that the flowers were fertilised and nuts formed before the well-known spear-shaped spathe opened, but this fallacy has now been corrected.

The flower spathe appears above a leaf and takes several weeks to attain its full length when it splits longitudinally down the side, liberating the tightly packed inflorescence and allowing it to expand and the florets to open out.

The inflorescence bears as a rule two kinds of flowers "male and female," the former being borne in hundreds and opening first, the latter being fewer in number, spherical in shape and resembling small nuts, from which the idea arose that the nuts were already formed before the spathe opened.

The female flower does not expand like an ordinary flower, but when ripe exposes the stigmatic surface in a small opening between three triangular segments. The pollen from the male flower falls on the stigma and fertilises the flower; but as the male flowers have all opened and fallen off from 2 to 5 days before the female flowers are ripe on the same inflorescence, the latter must be fertilised from a new inflorescence above the next leaf, or from a neighbouring tree.

MR. PETCH has shown that on the Peradeniya trees examined, the former would only be possible when a new inflorescence appears within 30 days of the former one and that this only occurs in May, September and October, which are usually the most active growing periods in Ceylon and the tropics generally.* The duration of the period that the female flowers are opening depends on the number on the inflorescence, 2 or 3 opening daily but the individual female flower is only receptive for 24 hours or less, from 3 to 4 weeks after the opening of the inflorescence. It is possible that the larger crops in May-July are due to this over-lapping and fertilisation on the same tree but more probably to the increased vegetative activity at that period of the year.

The pollen is conveyed either by the wind or bees or hornets, which are attracted by the nectaries at the base of a short column in the male flower, also the nectar on the stigma of the female flower.

That there is a great variation in the fruiting capacity of coconut palms is well known, and the importance of careful seed selection when forming a new plantation is fully recognised, though evidently not always observed.

A badly yielding tree however can be made to yield more heavily by cultivation and manuring, though whether the effect is to increase the number of female flowers on the newly forming inflorescence, or to cause

* MR. BAMBER is referring to the tropics north of the line.—ED. T.A.

more rapid floral production, within the 30 days necessary for fertilisation on the same tree, or the prevention of falling off of immature nuts has still to be determined.

Experiments are being conducted and data collected to prove these points, but it would greatly add to the value of such investigations if similar data were recorded by individual proprietors on their own estates.

Little is yet known as to the effect of any of the principal manuring constituents such as nitrogen, lime, potash and phosphoric acid on the formation of a larger proportion of female flowers on each flowering stalk, or whether moisture alone or in conjunction with one or more of these is the chief cause. The actual formation of the embryo leaves and flowers in the growing apex of the palm must take place some months before they actually appear, and it is of importance to ascertain what are the determining factors. MR. VANDERSTRAATEN of Negombo has made an investigation on this point, and it is hoped to continue this at Peradeniya during the year, where palms of different ages are available for sectional purposes.

The manuring experiments which have already been begun in different coconut districts, should enable this and several other questions to be solved, but careful records for several years must be kept before definite conclusions can be drawn, except on points of actual manuring, which should be available in 3 or 4 years.

Much has already been learned by practical experience from the manuring experiments on a large scale conducted by MR A. E. RAJAPAKSE and others, and the thanks of all coconut planters are due to these gentlemen who have allowed their experiences to be published for the benefit of the community.

The Low-Country Products Association could greatly assist its members if similar data of the practical experience of coconut planters were collected, and the results condensed for publication in their annual report, and I am sure that the Agricultural Department would gladly assist in making the deductions.

In framing any new experiments, it is important that each is made to determine one point only, and that dates, number of trees, climatic conditions and all factors likely to affect the result are carefully recorded.

COCONUTS IN CEYLON.

Though the price of coconut products has fallen somewhat compared with the high rates that ruled a few months ago, the outlook is as hopeful as ever for an industry which stands on a firm basis in spite of such rival products as the soy bean, African oil palm and other oil-yielding trees periodically reported to have been discovered in African and Philippine forests.

It is only of recent years that the study of the life history of the palm has been seriously taken up, and in this respect much useful work has been done in the Philippines.

Locally MR. PETCH has made a valuable contribution on the subject of the fertilization of coconut flowers.

MR. A. E. RAJAPAKSE of Negombo, a keen student of agriculture, has for some time been keeping careful records of his observations and experiments, and if others follow his example a valuable mass of information would before long be available.

The reports issued from the Experiment Station at Maha-iluppalama furnish useful data, and when these come to be supplemented by the results obtained at the Chilaw coconut trial ground, we shall have made some progress in the study of the palm under the special conditions which obtain in the drier parts of the Island, and the treatment it should receive in this environment.

The importance to which the coconut industry has attained has resulted in the issue of a number of works dealing with the cultivation of the palm; and more are promised. The Society's library at present contains the following volumes :—Coconut Planters' Manual (FERGUSON), The Consols of the East (HAMEL SMITH & PAPE), All about Coconuts (BELFORT & HOYER), The Cultivation of Coconuts (Anonymous).

The Low-Country Products Association is to be congratulated on the happy idea of a coconut conference (held in June) towards the success of which the presence of H. E. THE GOVERNOR materially contributed. It would be most appropriate, in view of the world-wide interest in this the most useful of our cultivated palms, that one of the oldest coconut growing countries should inaugurate a Coconut Exhibition open to all tropical countries.

In order to trace the growth of the export trade in coconut products from small beginnings till it reached its present proportions the following interesting statistical statement* prepared for the Society by the Hon'ble the Principal Collector of Customs is published for general information. Copies of this table have been furnished to MR. FREDRICK LEWIS to appear as an appendix to his paper on "The Fixed Oils of Ceylon" contributed to the Congress of Tropical Agriculture, and to the Editor of the TROPICAL AGRICULTURIST.—C.A.S. REPORT.

COCONUTS AT PERADENIYA.

100 young coconut palms were obtained from MR. V. M. RAJAPAKSE of Goluapokuna Estate, Negombo, who kindly gave these free of charge. These being from the same trees as the rest of the plots, they have been planted out in the holes previously prepared by dynamite. The total vacancies supplied in these plots this year is 179.

All drains have been cleaned, and round the trees clean-weeding has been done. All the plots have been disc-harrowed and are looking in a first-class state of cultivation.—PROGRESS REPORT, EXPERIMENT STATION.

* See pp. 21 and 22 of T. A. for July.—Ed.

COPRA DRYING.

C. W. HINES.

The coconut industry ranks among the most profitable industries in tropical countries, where conditions are at all favourable for the growth of the coconut tree. Here in the Philippines, it is grown extensively in some 16 provinces which supply about one-third of the world's output of dried copra. It seems very peculiar that more modern methods in the drying of this copra and in the extraction of the oil are not found. To the writer's knowledge there is but one modern factory turning out this oil in Manila to-day, the majority of the raw product being exported to the United States and to foreign countries.

GRADE OF COPRA FROM THE PHILIPPINES.

The greater part of the copra produced here is of poor quality, on account of the methods used in handling and drying. Besides the objectionable dark colour due to the long time required in drying and the effect of the smoke on the white meat of the copra, there are one or two other factors which have even greater influence. The first of these is the high moisture content of the dried copra. This is the main cause of most of the bacterial and mold formation on the copra, which not alone causes the finished product to present a bad appearance, but lowers the percentage of recoverable oil, as well as raising the percentage of free, fatty acids and other impurities. This, of course, also increases the expense to the manufacturer.

PROPER MOISTURE CONTENT.

In order to keep in good condition, copra must be sufficiently dried to prevent this bacterial attack. Numerous experiments have proved that under ordinary conditions, copra containing 5 per cent. or less of water will keep perfectly, even during the wet season. Of course, well-dried copra will take on a slight amount of moisture during wet weather, but this will not cause any great harm if the copra was thoroughly dried previously. The greatest destruction comes when the moisture content is from 10 to 16 per cent. At this time the different molds thrive best and consequently cause the greatest deterioration of the oil of hydrolization. A moisture content between this and the standard 5 per cent. will prove somewhat less favourable to the bacterial action as well as to the mold growth, but this will still be destructive to the copra and cause a decrease in value.

SUN-DRIED COPRA.

The ordinary sun-dried copra on the market contains from 8 to 14 per cent. moisture, which fully accounts for its very poor condition after standing a short time. This copra often contains as high as 3 per cent. fatty acid, which is a waste product derived from the valuable oil of copra. The buyers of this grade of copra would necessarily be forced to pay much less per ton than for a prime article. In the first place, the appearance is very much impaired and, secondly, there is a loss in the oil content.

It is easy to see, then, why the producer of low-grade copra receives a lower price for his product than does a neighbour who uses an up-to-date apparatus requiring but four or five hours for complete drying. In case of cloudy weather or showers, the task of sun drying becomes more difficult, and when continued rains prevail, as during the wet season, the task is almost impossible.

OPEN-DRYING COPRA.

In this method of drying, a framework is built of bamboo, about 1 meter from the ground, and on this the split nuts are laid. A fire is then built underneath with the husks and shells from the nuts. No attempt is made to carry away the smoke from the drying coconut meat, nor is there any special provision made to prevent the superheating of certain parts. The usual result of these two evils is a very dark and badly smoked copra, while quite often a large percentage is partly charred. In some regions this method is practised quite extensively, while in others it is used only during the rainy season. It is obvious that only a low-grade copra will ordinarily result from either of the above methods, yet it is strange that the greater part of the copra from these Islands is produced in this manner.

MODERN DRYING APPARATUS.

In modern manufacture ovens specially constructed are used in drying sugars, cacao, fruit, etc. Only recently have several apparatus been introduced for the drying of copra by artificial means. As far as the grade of copra is concerned, they have thoroughly demonstrated their superiority over the antiquated methods by turning out a perfectly white copra with splendid keeping qualities. The time required for this drying to a moisture content of 5 per cent. is from four to six hours. This is, of course, a great saving of time, and gives the producer an opportunity to secure the top price for his product. While these apparatus are comparatively new, and still in the experimental stage, yet there is no doubt but that the right method of heat transmission has been discovered, and this is one of the most important factors. Another factor, of perhaps as great importance, is the ability of the operator to maintain the desired temperature at the different stages of drying.

STEAM-DRIER.

Some time ago the Bureau of Agriculture introduced a drier containing a series of 2-inch (50 millimeter) tubes, placed near the bottom, through which the steam for drying the copra was introduced. The grade of copra produced by this apparatus was very good and it was found that perfect control could be had in the manipulation of the drier. The steam in this case was produced from the husks and shells of the coconuts under an ordinary boiler.

Another drier has been in use in Laguna Province which aims at a better distribution of the heat by having its steam pipes arranged through the apparatus at various heights instead of at the bottom only.

THE MAYFARTH DRIER.

This apparatus is built on distinctly different plans from the above. A blast of hot air furnishes the heating medium, and the partly dried nuts are moved along during the drying by means of a mechanical arrangement propelled by an operator. This apparatus was subjected to extensive experiments during the past year by the Compania Tabacalera of Manila.

To the writer's knowledge there are none of these driers in operation on plantations here to-day.

McCHESNEY'S HOT-AIR COPRA DRIER.

This represents one of the latest designs and one of the very best that has been introduced, so far as the quality of the dried product is concerned. The principle upon which this operates is that air heated in a metal oven placed above the furnace is forced through a series of pipes containing

perforations, and thus an air pressure is maintained in the oven itself until a certain amount of the water has been removed. The broken nuts are placed in trays and left to dry for about one hour at a temperature of 90° or 95° after which the shells may be easily removed and the meat cut into strips, which are again placed in trays and dried for about three hours. The temperature during this time is maintained as high as possible without causing decomposition of the tissue, which will result from excessive heat. About three or four hours of this second drying is usually sufficient to produce a first-class copra.

PROPER METHOD OF DRYING.

When the drying is first begun the temperature may be allowed to reach 95° or even 98° until the nuts are ready to be removed from the shell, after which about 85° should be the maximum temperature for the first hour and then a gradual drop should obtain for the two succeeding hours until 65° is reached. Great care must be exercised when the final product is nearly secured, since at this time decomposition from heat may easily result. It is thus better to use a lower temperature and more time during the final drying. Copra dried under these conditions and properly packed should keep well and contain a minimum of fatty acid. Such copra should therefore command the highest price in foreign markets, and cost the producer probably less, or at least no more, than copra obtained by the old methods. One advantage in producing a superior article in any line is that there is always a sure and steady market for this product as well as an opportunity to secure the highest market price.

THE MANUFACTURE OF OIL.

The percentage of oil contained in the fresh meat of the coconut usually runs from about 30 to 45 per cent. The percentage contained in the dried product will be largely governed by the percentage of moisture remaining. It will, of course, contain a lower percentage of oil than the oven-dried, which will often reach 70 to 80 per cent. when its moisture content has been greatly reduced.

There are two processes commonly used in extracting this oil—the hydraulic and the continuous. The former usually gives a higher extraction but is slower in operation than the latter. Both processes are used in America and Europe. The continuous-process method is an American invention.

The press cake remaining after the oil is removed makes a valuable cattle feed and also an excellent fertilizer. In either case it is well that only a very low oil content remain.

Sometimes a solvent is used in the extraction of oil and it is imperative that this chemical be non-injurious to the animals, should the press cake be used as stock feed.—Philippine Agricultural Review.

COCONUTS IN THE DRY ZONE.

The sixth picking of 1914 was made on July 14th. The number of nuts collected was 2,781 from 325 trees—an average of 8·5 nuts per tree.

This gives a total of 6,984 nuts for the pickings of 1914 to date, from an area of 23½ acres composed of 17 acres of 6 year old and 6½ acres of 7 year old trees.

In the cultivated area (6 year old trees) 294 trees gave 2522 nuts, an average of 8·5 nuts per tree.

In the uncultivated area (7 year old trees) 31 trees gave 259 nuts, an average of 8·5 nuts per tree.

The seventh picking was made on August 13th. The number of nuts collected was 2,400 from 389 trees, an average of 6 nuts per tree.

This gives a total of 9,384 nuts for the pickings of 1914 to date, from the area as defined above.

In the cultivated area, 358 trees gave 2,229 nuts, an average of 6 nuts per tree.

In the uncultivated area, 31 trees gave 171 nuts, an average of 5·5 nuts per tree.

With regard to copra production, the following figures have been obtained:—

Picking	*Break*	*Rejections*	*Copra lb.*	*No. of nuts per candy.*
		Combined Plots.		
April	920 nuts	1	408	1,249
May	1,847 ,,	2	805	1,262
		Plot A.		
April	810 ,,	1	368	1,217
May	1,685 ,,	2	753	1,229
		Plot B.		
April	110 ,,	0	40	1,540
May	162 ,,	0	52	1,744

PROGRESS REPORT, EXPT. STN, MAHA-ILLUPPALAMA.

THE DIRECTOR, IMPERIAL INSTITUTE.

PROFESSOR W. R DUNSTAN, C.M.G., F.R.S., Director of the Imperial Institute, was a visitor to Ceylon early this year and made a tour of inspection which covered the greater portion of the Island. When not travelling his time was fully occupied with matters agricultural and mineralogical, and he devoted much time to conferences about Rubber Research, the proposed College of Tropical Agriculture, and other agricultural questions. PROFESSOR DUNSTAN was present and spoke at the meeting of the Board held on February 3rd of this year.

In view of the valuable work which the Imperial Institute is doing in developing the natural resources of the British Colonies, the opportunity which the Director's visit afforded those connected with planting and general agricultural interests to come into personal contact with him was greatly appreciated,—C. A. S. REPORT.

CACAO.

CACAO AT PERADENIYA.

A Bulletin has been compiled bringing up the cacao experiments up to date and will soon be published.

One round of picking has taken place yielding a small gathering.

The newly-cleared hill-side piece of three acres, above plots 73-77, has been well drained and sown with Tephrosia candida and Leucæna glauca interplanted with dadaps 20 × 20 feet. Between the dadap rows, holes have been opened with half-cartridges of dynamite, 20 × 20 feet. It is proposed to plant these with the different varieties of cacao in October, by which time the green manure should be well up, affording a thick screen from the wind and shade from the sun, besides yielding a good mulch for the dry weather—three things essential to the well-being of young cacao plants.

The cacao required for these plots has been planted in baskets from specially selected seed of the required varieties.—Progress Report, Peradeniya Experiment Station.

CACAO FERMENTATION.

ARTHUR W. KNAPP, B.Sc. LONDON.

(*Continued from page 198*).

SWEATINGS.

These are generally allowed to run into the ground in the immediate neighbourhood of the sweat-box. This is bad, for the air round the sweat-box should be kept as sweet as possible. The sweatings should be collected in a clean, covered cement-lined pit, or better, in a glazed earthenware pot. It has been frequently suggested that sweatings might be commercially converted into varnish or vinegar. I found in one experiment that a barrel (300 lb.) of wet beans gives a little more than 1½ gallons of sweatings, thus

After 18 hours	...	...	7·2 pints
From 18-40 hours	...	...	5·2 ,,
Total	...	...	12·4 ,,

or roughly 1 cwt. of dry beans gives 1½ gallons. The amount of sweatings naturally varies according to the juiciness of the pulp and will be found to contain about 15 per cent. of solid matter, about half of which appears to be sugar. The acidity is at first a little less than 1 per cent., reckoned as acetic acid. A sample which I left in an open, but covered, jar for nine

weeks reached a final acidity of 1·9 per cent. The sweatings contain a fair percentage of a gelatinous colloid (pectin) which appears hitherto to have been overlooked. However, considering the difficulty of conveyance of simple machinery (e.g., for bottling) to the plantation or the cost of carriage of the fermenting sweatings to a centre in the town, there is little prospect of making profitable use of the sweatings. To obtain a pleasant vinegar would require more intelligent labour than is readily available.

Under present conditions the only way to produce a uniform product would be to boil (i.e., sterilize) the sweatings as soon as collected (thereby, unfortunately, losing some of the alcohol and pleasant-smelling esters), and when cold add a pure culture. In Trinidad there must be over 500,000 gallons of this unstable liquid going to waste every year, but at present there are many difficulties in the way of working the sweatings commercially, the chief being that the quantities to be treated in one place are small. This difficulty and others would be readily surmounted if the cocoa from some twenty estates were conveyed *in the pod* to a central factory near a large town. Such a factory could afford to employ a chemist and an engineer, and fermentation and drying would be put on a scientific basis. Doubtless the fermentation would be assisted by pure cultures. Under these conditions the sweatings (as vinegar or a drink resembling cider) would become a valuable by-product, worth probably 5 per cent. of the cocoa produced. Further, the pectin in the pods and sweatings might be used as a basis for jelly-making.

DURATION OF FERMENTATION.

It is possible to continue the fermentation too long. This is indicated by the growth of mould; and if the beans are left for fourteen days, they will probably become grubby. The growth of mould is always a great danger, and the following *hints to improve and increase the speed of* fermentation may be found useful :—

(1) Cover the beans immediately they are put in the box.

(2) *Use of Sweatings.* - Carefully save the clean sweatings which come from one box of beans, and pour over the box picked on the following day. It was found that the beans so treated were one day ahead of untreated beans throughout the fermentation. The beans produced had a fine plump appearance, were superior to those obtained by ordinary methods, and gave an excellent product on roasting. Another experiment showed that time could be saved in the same way by adding about 1 pint of *yeast* (from a brewery) to 8 cwt. of beans, as soon as they were put in the box. An attempt to make use of the dry cakes of *tinned yeast* sold to bakers was not so successful.

(3) When, because the pulp on the bean is very dry, or for other reasons, moulds tend to develop, the addition of 1 lb. of glucose in 1 gallon of water will encourage the right kind of fermentation. Raw cane sugar might work almost as well.

RISE OF TEMPERATURE.

The temperatures given are those that should be obtained in Trinidad, with a box 4 ft. by 4 ft., packed with beans to a depth of 3 ft.

TAKING TEMPERATURES.

In taking temperatures the bulb of the thermometer should be placed as near as possible to the centre of the mass. The mass is generally warmest one-third of the depth from the surface, but the difference in temperatures, save for the very bottom, which is always colder, should not be more than 3° C. The following are examples of the less uniform readings taken :—

Depth from surface.			Temperatures, degrees Cent.
4 in.	...	...	29, 34, 39, 38, 43, 44½, 43, 47½, 50
1 ft.	...	...	28, 32, 38, 41, 40, 47½, 46, 48½, 48
1 ft. 6 in.	...	...	30, 41, 48, 45
bottom	...	...	29½, 36, 36, 38

In ordinary boxes the temperature of the mass naturally falls off a degree or two towards the outside, e.g. :—

	Box.			
	Centre	5 in. from side	At side	Air out-side
Temperature C.	48	46	43	30·5

The temperature is the simplest guide to the amount of fermentation taking place, and the uniformity of the temperature in all parts of the mass is desirable as showing that all parts are fermenting evenly.

In conclusion I may say that I could never have gathered the material of this paper but for the courtesy of the planters ; and I publish it in the hope that it may be of interest to them.—TROPICAL LIFE.

C. A. SOCIETY'S GARDENS.

Satisfactory progress continues to be made at the Society's gardens at Bandaragama, Weragoda, Balangoda, Jaffna, Vavuniya and Badulla which are chiefly devoted to fruit and vegetable cultivation. At the Ambalantota, Balalla, Hettipola and Nikaweratiya gardens the chief crop was cotton which only at Ambalantota can be said to have given promising results. Castor and American maize also did exceedingly well at Ambalantota and the seed was used for distribution. Maize also gave good results at Jaffna. The Mediwake (Upper Dumbara) garden which is directly under the Teacher of the Government School has done much for the district through the introduction of cotton, tobacco, potatoes, etc.

The Balangoda garden worked under the supervision of MR. L. A. D. SILVA is deserving of special mention. Excellent plots of different varieties of sorghum were raised here and a good seed crop secured. Lucerne has also done fairly well.

These gardens not only serve to spread the cultivation of local fruits and vegetables but through them new economic crops are being introduced. In this work they are greatly assisted by School Gardens of which there are now 280.—C. A. S. REPORT.

COTTON.

In connection with the Society's efforts to introduce cotton cultivation into the Hambantota district MR. KARUNANAYAKE, Agricultural Instructor, furnishes the particulars given below of crops of Allen's Long Staple cotton grown by villagers on chena lands where planting was done at the proper time and no damage was done by wild animals. The seed cotton was s ld to MESSRS. FREUDENBERG & CO., the local Agents of the British Cotton Growing Association.

Situation.	*Owner.*		*Extent.*
Kurundana.	Mudaliyar Amarasekera.		2 Acres.
	INCOME.		
1720 lbs. at Rs. 13/50 per cwt.	Rs.	207·30	
400 ,, ,, /05 per lb. 2nd grade sold locally	,,	20·00	227·30
	EXPENDITURE.		
Clearing	Rs.	20·00	
Cost of Seed	,,	1·00	
Planting	,,	10·00	
Weeding	,,	15·00	
Plucking	,,	20·00	
Trasport Charges to Hambantota	,,	4·00	
Shipping Charges, etc. ...	,,	17·20	
Picking 2nd grade ...	,,	7·50	94·70
		Net profit	132·60
Wanduruppu.	D. J. Subasingha.		2 Acres.
	INCOME.		
1800 lb. 1st (& 2nd grade) at Rs. 13/50 per cwt.	Rs.	216·00	216·00
	EXPENDITURE.		
Clearing	Rs.	30·00	
Seed	,,	1·00	
Planting	,,	7·50	
Weeding	,,	15·00	
Picking and grading ...	,,	45·00	
Transport to Hambantota ...	,,	3·00	
Shipping Charges, etc. ,	,,	18·00	119·50
		Net profit	96·50

Situation.	*Owner.*	*Extent.*
Ambalantota.	High Priest, Ambalantota.	1 Acre.

Income.

951 lb. at Rs. 13/50 per cwt. (2nd grade not picked)	Rs.	114·75	114·75

Expenditure.

Clearing	Rs.	10·00	
Seed	,,	50	
Planting	,,	5·00	
Weeding	,,	10·00	
Picking and grading ...	,,	35·00	
Transport to Hambantota ...	,,	3·00	
Shipping Charges, etc. - ...	,,	9·50	73·00
		Net profit	41·75

The produce of the Society's Experimental Garden at Ambalantota was forwarded to Liverpool whence a report has not yet been received.

Seed of a new cotton was received in September last from the Secretary of the British Cotton Growing Association. It was described as the result of a hybrid obtained from Sea-Island seed by Mr. Thomas Thornton. The experience of this variety is not encouraging, inasmuch as it tends to produce an excess of foliage and does not boll freely, besides yielding a late crop.

At Mediwake, Cambodia cotton, which is making headway in Southern India, has proved to be more suitable to the district than Allen's long staple. This variety produces a sturdy plant which is a prolific yielder though the lint has not the same quality as Sea-Island or American long staple.

Seed of Durango Cotton reputed to be specially suited to arid areas has come from the U. S. A. Department of Agriculture and is being given a trial at Jaffna, Hambantota, Kurunegala, Batticaloa and Anuradhapura districts.—C. A. S. Report.

SPONGES AS A FERTILIZER.

J. G. SMITH.

"Loggerhead" sponge is a large sponge of the gulf of Mexico ; it grows abundantly on the coasts of southern Florida, and appears to be used with wonderful results as a fertilizer, especially by the citrus fruit growers. From analyses made at the United States Department of Agriculture it appears that the approximate composition of air-dried material is the following: 4 per cent. nitrogen, 0·75 per cent. each of potash (K_2O) and phosphoric acid (P_2O_5), 5 per cent. of lime (CaO and MgO, mainly the former) and 40 per cent. organic matter It is probable that other non-commercial species of sponges have a similar composition. If so, and from their demonstrated efficiency as a fertilizer, they deserve to be seriously considered as such wherever they are of easy access.

With a view to determining the feasibility of extending their use, further investigations are in progress.—Monthly Bulletin.

PADDY.

THE PRINCIPLES OF PADDY MANURING.

W. H. HARRISON.

In the manuring of crops many factors come into operation and it is only after a careful consideration of these that a manure suited to the needs of a crop and the soil on which it is grown can be selected. The chemical and physical properties of the soil, the particular requirements of the crop grown, the type of soil and the methods of cultivation employed are among the most important factors to be taken into account and as many of these apply with particular force to paddy cultivation, they determine to a very large extent the kind of manure employed and the manner of applying it.

Paddy cultivation as practised in Southern India differs essentially from ordinary cultivation in (1) that the land is prepared for the reception of the crop by a system of puddling and (2) the land is kept flooded and therefore saturated with water during the greater part of the growing season. These two factors dominate the whole of the conditions under which paddy is grown and their effect on the soil and the plant must receive careful consideration if the manuring of paddy is to be placed on a rational basis.

The puddling of paddy land previous to transplanting affects the physical condition of the soil mainly by bringing about the disintegration of the soil particles and thus increasing their number and producing a finer and more clayey texture. This effect is not confined to the first few years after a soil is brought under paddy, but continues so long as the land is thus utilised, so that unless counteracting influences are brought to bear, a paddy soil tends to become heavier in character as years go by. This is well shown by certain analyses carried out at Chaganoor in the Bellary District. Here the ordinary dry soil bordering some isolated paddy fields contained approximately 13 millions of particles in every grain of soil, whereas the land which had been under paddy cultivation for about four years contained $14\frac{1}{3}$ millions, and land which had long carried paddy crops $20\frac{1}{3}$ millions. Further it is an invariable rule that paddy land has a finer texture and heavier character than the surrounding dry lands. The fact that paddy cultivation produces a heavier and closer soil being thus demonstrated, the first problem which presents itself in the manuring of such lands is the question of using manures which will tend to counteract this effect should the object aimed at in manuring be to produce a lighter and coarser soil and so counteract the effects of the methods of cultivation or should the manure act by accentuating these effects?

THE PHYSICAL EFFECT OF MANURES.

This problem can be solved by employing the principles which apply to dry land farming. Here certain manures cause the very fine particles of a soil to become cemented together to form compound particles, thus producing a coarser texture and a lighter soil, whereas another set of manures have

the opposite effect and by destroying the compound particles already existing in a soil a finer texture is produced. To the former class belong those manures which contain large quantities of organic matter and which on undergoing change in the soil yield humus, a substance which has a decidedly beneficial effect on the texture of soil. In the latter class may be placed many artificial manures of the type of ammonium sulphate, etc.

By applying representatives of these two classes to a paddy soil and contrasting the relative effects on the crops, it is possible to arrive at a general conclusion. Such an experiment has been in operation on the Central Farms, Coimbatore, for several years, in which the effect of a green manure was tested against similar land to which a mixture of bone-meal and potassium sulphate was applied as a manure. As in both cases, nitrogen, phosphoric acid and potash were added to the soil with the manures applied, such an experiment gives directly the effect of the bulky organic manure. With daincha as the green manure crop, a yield of 4,200 lb. of paddy was obtained, with wild indigo about 1,300 lb. and with calotropis leaves 3,877 lb., whereas the comparison plot only yielded 2,652 lb. Another plot to which another type of bulky organic manure was added, namely, castor-cake, yielded 3,550 lb. of paddy. Thus the addition of a bulky organic manure to a paddy soil gives better crops than a manure containing little organic matter, but which has approximately the same manurial value. Consequently it may be stated that the first essential of a paddy manure is that it should contain a large proportion of organic matter capable of producing humus, thus counteracting the tendency of such soil to become finer in texture and heavier in character.

THE NITROGEN FACTOR,

Taking the next factor, the fact that the land is kept fully saturated with water throughout the greater part of the growing seasons means that there is practically no free oxygen present in the soil and this draws at once a sharp distinction between paddy cultivation and that of ordinary field crops. The presence or absence of air in a soil determines to a very great extent the course of the changes undergone by the nitrogen in a manure before it is incorporated with their plant tissues, and in ordinary soils the nitrogen of the manure after undergoing many intermediate changes unites with the oxygen of the air to form nitric acid, a substance which is easily absorbed by the crop and the nitrogen it contains easily utilized for the purposes of the plant. On the other hand in paddy soils no oxygen being present, instead of nitric acid, ammonia is produced, but it has been shown in Japan that the paddy plant readily assimilates this substance and consequently the product of the decomposition of many manures in such soils are suitable for the needs of the plant and there is no need to endeavour to alter the ordinary course of affairs in this respect.

Fermentations which take place in the absence of free oxygen are known as anærobic fermentations and that this is the type of fermentation which takes place in paddy soils is shown by the composition of the bubbles of gas which are evolved. The gases found are the same as those obtained from marshes and bogs where the fermentation is known to be anærobic. Under these anærobic conditions, nitrates are decomposed and the nitrogen they contain liberated in the free state, a form in which nitrogen is of no value as a plant food to paddy as well as to all cereal crops and consequently manures containing nitrates should not be used for the manuring of paddy.

NITRATES Vs. AMMONIUM SALTS.

Further, as these soils are kept saturated with water any substances which are soluble in water and which are not retained by the soil are liable to be wasted away and lost and nitrogen when in the form of nitrates is particularly liable to be washed away. On the other hand, the danger of loss by washing away ammonia is very slight, for although the substance is very soluble in water, the soil has such an attraction for it as to remove it from solution and so prevents any loss by leaching occurring. These considerations lead to the conclusion that nitrates in any form are not suitable manure for paddy, whereas ammonium compounds or substances which yield ammonia under anærobic conditions are useful, and actual experiments at Coimbatore has shown that calcium nitrate and saltpetre are of little value when applied to a paddy crop.

The factors discussed above have, so far as manurial ingredients are concerned, dealt only with the utility of the different form of nitrogen, whereas all manuring must have reference to the supply of potash and phosphoric acid as well.

Paddy being a cereal, the general requirements of that class apply in so much as those crops respond to the application of nitrogen and phosphoric acid, and these manurial ingredients are therefore the ones most generally used, whereas potash is usually only applied when the soil is known to be deficient in that respect.

POTASH.

Thus, broadly speaking, in manuring these crops attention is primarily paid to supplying an adequate amount of nitrogen and phosphoric acid, the supply of potash only receiving a secondary consideration. That this holds good for paddy is shown by the results of manurial experiments carried out in the Gódáveri and Kistna deltas and at Coimbatore, for out of seven experiments the use of nitrogen and phosphoric acid gave an increased yield over nitrogen alone and further in five of the cases, the addition of potash actually produced a decreased yield. For instance, at Coimbatore, nitrogen (in the form of a green-manure crop) and phosphoric acid gave a yield of 3,733 lb. of paddy and 4,043 lb. of straw per acre, whereas nitrogen, phosphoric acid and potash gave only 3,294 lb. of paddy and 3,228 lb. of straw. Thus the need for supplying potash in paddy manuring is comparatively unimportant and is determined chiefly by the character of the soil on which the crop is grown. This is an exceedingly fortunate result to obtain, for potash is expensive and consequently the fact that its use can usually be dispensed with decreases very greatly the cost of manuring. It is true that in these experiments the use of a comparatively large amount of potash has often led to a large increase in yield, but in these cases, the cost of the manure supplied has often been greater than the increased value of the crop obtained and has in fact resulted in a small loss to the cultivator.

The position arrived at so far may be summarized as follows :—

1. Paddy soils need manuring with bulky organic manures which readily decompose under anærobic conditions yielding humus.

2. Nitrates are unsuited for the purpose, whereas ammoniacal manures or manures which yield ammonia under anærobic conditions of fermentation are of great value.

3. Nitrogen and phosphoric acid must be applied to all paddy soils, whereas potash should only be applied when the soil is in particular need of that ingredient.

Having now briefly summarized the conditions peculiar to paddy cultivation, and their effect on the question of manuring that crop, it becomes necessary to review the manures available in Southern India for this purpose and to discuss briefly their utility. For this purpose, the manures may be classed as follows :—

Bulky Organic Manures.—This class includes most of the popular manures for paddy, e.g., green manures, poonacs, farmyard manures, fish manures, etc., and all of them are characterised by the large proportion of organic matter they contain and, as decomposition must take place before either humus is formed or the manurial ingredients become available as plant food, it is necessary to apply them some time before transplanting. The rate of decomposition of these manures is, however, very rapid under the conditions most obtaining under paddy cultivation and within less than one month it has proceeded far enough to be of benefit to the young plants and consequently there is usually no necessity to apply these manures more than one month previous to the time of transplanting. On the other hand, if applied only very shortly before transplanting, the manure is not sufficiently decomposed to be of much value to the plants, and, in addition, actual harm may occur owing to the products of decomposition seriously affecting the growth of the crop.

GREEN MANURE.

Wherever the local conditions render it possible to grow a crop previous to a paddy crop, manuring by means of a green manure crop may be carried out. Such crops as *Sesbania aculeata* (daincha), *Crotalaria juncea* (sunn-hemp), *Tephrosia purpurea* (wild indigo), *Phaseolus mungo* (green gram), etc., through the agency of peculiar bacteria which live on their roots possess the power of assimilating the free nitrogen of the atmosphere and storing it up in their tissues. On ploughing these crops into the soil, decomposition takes place and the nitrogen they have absorbed becomes available for the next crop. In other words, through their use, the cultivator has the power of obtaining the usually expensive nitrogen at a very low cost and consequently green-manuring must not be despised. The nitrogen supplied to a crop by means of poonacs costs from 8 to 8½ annas per lb., that supplied by means of artificial manures costs about annas 10 per lb , whereas the nitrogen supplied by a green-manure crop is obtained merely at the cost of ordinary cultivation charges and may be put down as a maximum of one anna per lb., and, usually, the actual figure is much less than this.

Under favourable conditions, daincha will grow to a height of over 8 feet, and enough can be grown on one acre to supply sufficient nitrogen to manure about four acres of paddy. Sunn-hemp, being a smaller growing plant, will not yield so much green manure, but even in this case the produce of one acre will answer for over two acres of paddy. Wild indigo and the grams being, in comparison to the above, only dwarf plants, the amount obtained from an acre should, unless the crop is very heavy, be applied to the land on which it is grown.—JOURNAL OF THE BOARD OF AGRICULTURE, BRITISH GUIANA.

PADDY (RICE).

EXPERIMENTS BY THE CEYLON AGRICULTURAL SOCIETY.

During the year under review a series of experiments in transplanting and manuring was carried out. The following statement gives the results of transplanting experiments carried out by MESSRS. MOLEGODE and NUGAWELA, Agricultural Instructors.—

A. Centre:—Watuwela in Harispattu. Paddy:—Hatiel 7 months.

No.	Size of plot.	No. of seedlings per hole.	Distance apart.	Yield per plot. grain. meas.	grain. lb.	Straw lb.	Calculated yield per acre approximately grain Bushels.	Straw lb.
1	25 × 25 ft.	Single	3 × 3	11½	14	30	29	2100
2		Two	3 × 3	14	18	39	35	2730
3		Three	6 × 6	15	20½	46	37	3220
4		Four	6 × 6	24	30	62	60	4640
5		Two-five	2—6	20	26	40	50	2800
		B. Centre:—Nugawela in Harispattu.						
1	100 × 20 ft	Single	2 × 2	30	38	73	23	1587
2		Two	3 × 3	40	48	129	31	2805
3		Two	4 × 4	70	84	161	54	3501
4		Three	6 × 6	55	72	139	42	3012
5		Four	6 × 6	55	82	149	51	3240
6		Village method		60	79	140	46	3045

Mr. P. B. M. BANDARANAYAKE, Agricultural Instructor, Badulla, furnished the following results of an experiment at Hagoda in Badulla:—1½ acres was cultivated with transplanted seedlings from 1½ bushels paddy, clumps of 3 plants being planted 6 in. apart. The yield was 60 bushels grain and 2,200 bundles straw. The paddy which was of superior variety known as "Japan wi" fetched Rs. 2·50 per bushel and the straw at Rs. 1·00 per 100. The total cost of cultivation was Rs. 78 (including cost of transplanting Rs. 18/-) showing a profit of Rs. 94/-

MR. M. J. A. KARUNANAYAKE, Agricultural Instructor, has supplied the following particulars of paddy cultivation by single seedlings carried on by MR. J. RODRIGO, of Godigama:—Single seedlings raised from a bushel of selected Muttusamba seed were planted 4 in. apart on 4 acres of well manured land. The time allowed the plants in the nursery was 30 days. The yield of grain averaged 90 bushels per acre.

MR. W. MOLEGODE, Agricultural Instructor, carried out the following trials at Gallella village in Harispattu. A field of ½ acre was divided into 2 plots of ¼ acre each. The transplanted plot gave 15 bushels and 17 measures and the broadcasted plot 9 bushels 24 measures.

MR. MOLEGODE also tested a thin sowing against thick sowing at Uduwawela on an acre with the following results:—

35 measures broadcasted on ½ acre gave 22 bushels 24½ measures and 346 bundles straw.

17½ measures broadcasted on ½ acre gave 15 bushels 10½ measures and 162 bundles straw.

MR. BANDARANAYAKE, Agricultural Instructor, Badulla, is making a further test of the same character.

The Secretary's manuring experiment at Peradeniya referred to in the last Progress Report was concluded in March and the following are the yields per acre:—

1. Manured with 4 cwt. bone meal	47 bushels.
2. Manured with $2\frac{1}{2}$ cwt. bone meal and sulphate of potash mixture with a top dressing of 1 cwt. nitrate of soda	$54\frac{1}{3}$,,
3. Unmanured	24 ,,

MUDALIYAR RAJAPAKSE furnishes the following results of manuring and transplanting experiment conducted by him :—

Method.	*Manure.*	*Yield per Acre.*
2 bushels broadcasted	2 cwt. crushed bones	42 bushels.
24 measures transplanted several plants 9 in. apart	$\frac{1}{2}$ cwt. bone meal	59 ,,
20 measures transplanted several plants 9 in. apart	20 lb. bone meal 14 ,, kainit	47 ,,
15 measures transplanted single seedlings 9 in. apart	20 ,, bone meal 14 ,, kainit 14 ,, fish	67 ,,

The Matale field of 3 acres was sown with green gram (*Phaseolus max*) and Mè (*Vigna sinensis*) during the interval between two paddy crops. The crop succeeding the application of green manure gave $110\frac{1}{2}$ bushels grain and 2496 bundles straw against 86 bushels grain and 1534 bundles straw before green manuring. The total cost of growing the green manure was Rs. 33/81 and by the sale of Mè and green gram a sum of Rs. 21/21 was realized.

The following is the programme of work in connection with the cultivation of sunn hemp preparatory to paddy:—

Name of Instructor.	*Extent of Experiment.*	*Situation.*	*Date of Sowing*
Mr. L. A. D Silva	1 acre	Ratnapura Town	Middle of May
Mr. K. Chinnaswami Pillai	1 ,,	Rakuli veli Kinniya Village	5 August
Mr. L. De Z. Jayatilleke	1 ,,	Kosgoda	2nd week Aug.
do	1 ,,	Batapalagama	do
do	1 ,,	Hiniduma	30th June
Mr. S. Chelliah	2 ,,	Nallur	July
Mr. Jas. R. Nugawela		Mediwaka	September
do	2 ,,	Nugawela	1st July
do	3 ,,	Matale	July (end)
do	$\frac{1}{2}$,,	Udispattu	4th July
Mr. A. Madanayake	1 ,,	Tissawewa	1st June
do	1 ,,	Kekirawa	5th June
do	1 ,,	Mihintale	5th June
Mr. C. H. de Saram	1 ,,	Anamaduwa	19th May
do	1 ,,	Chilaw	do

Name of Instructor.	*Extent of Experiment.*	*Situation.*	*Date of Sowing.*
Mr. M. J. A. Karunanayake	2 ,,	Alutgama	Middle of July
Mr. W. Molegode	½ ,,	Uduwawela	July
do	½ ,,	Molegode	September
do	½ ,,	Dunuwila	August

DR. LOCK's selected Hatiel seed was resown last season at 4 centres all in the neighbourhood of Peradeniya. The work of seed selection was continued by the Society and 50 bushels of selected seed of this variety are available for distribution.

The Secretary, Planters' Association of Ceylon, wrote asking whether the Society could arrange experiments in growing varieties of rice generally consumed by estate labourers under the irrigation tanks side by side with local varieties. Enquiries were made to ascertain what rices were most largely consumed by the estate coolies, and fourteen samples from the Kandy markets were submitted to the Secretary, P.A. Of these 4 varieties, viz:—Muttukalunda, Soolai, Saigum and Seigun have been selected for trial. The Society is trying to procure the necessary seed and it is expected that MR. HARBORD of the Agricultural Department will carry out a trial at Maha-iluppalama, while the Agricultural Instructor, N. C. P., will make a similar trial in another locality.

A bulletin embodying results of the work on paddy carried out by the Society from its inception is in course of preparation.

This section of the report would not be complete without an acknowledgment of the services rendered by MR. EDWARD ELLIOTT, late of the Ceylon Civil Service, who has written an exhaustive history of paddy cultivation in Ceylon, serially contributed to the TROPICAL AGRICULTURIST. Coming as it does from one who as a provincial administrator acquired a wide experience of native agriculture and subsequently gained a practical knowledge of paddy-cultivation, this contribution to the literature on the subject has a special value. It is to be hoped that the papers will be reprinted in book form.

The Director of Irrigation has been good enough to furnish the Society with the following list of the larger restored tanks and their approximate irrigable area in acres:—Giants Tank 20,000; Kanthalai 5,200; Rugam Tank and Anicut or Rugam scheme 7,290; Vakaneri Tank 13,360; Kalawewa 17,000; Minneri Tank 9,000; Nachchaduwa Tank 6,968; Nuwarawewa 1,021; Sangilikandarawa 785; Magallawewa 1,236; Mediyawa Tank 1,260.—C. A. S. REPORT.

RICE IN QUEENSLAND.

According to the QUEENSLAND AGRICULTURAL JOURNAL uplands or mountain rice thrives and yields heavy crops on the coast lands from the Southern border to the Far North at Cairns. With only fair cultivation the yield was 30 to 40 and up to 60 bushels paddy per acre worth 4 to 5 shillings per bushel delivered at the mill, besides 3 to 4 tons of straw worth £2 to £3. In favoured districts it is possible to get two crops a year.

The land for rice cultivation is prepared in the same way as for wheat and the seed is sown broadcast at the rate of 60 lb. per acre or in drills 2 ft. 6 in. apart with 10 inches between the plants.

This report of successful results under dry conditions in a region where the rainfall is small would go to indicate that given a thorough system of tillage paddy cultivation should be possible in the drier parts of the Island, without the aid of irrigation, if a suitable strain were selected.

C. D.

PADDY EXPERIMENTS AT MAHA-ILLUPPALAMA.

An experiment was started during the third week of June 1914. Five acre plots have been prepared to receive a crop of Suduvi, a four months paddy, yielding a white rice, the object being a comparison of different rates of broadcast sowing and different distances apart of transplanting.

The five acre plots were treated as follows :—

Plot	1.	Broadcast	$\frac{3}{4}$ bushel
,,	2.	do	1 do
,,	3.	do	$\frac{1}{2}$ do
,,	4.	Transplant	one foot apart
,,	5.	do	nine inches apart.

Early in July, on the understanding that experiments in growing varieties of rice generally consumed by estate coolies, were to be put in hand next season, in order that a sufficient number of plots should be available, I caused plots 4 and 5 to be ploughed up.

There are therefore six acre plots available for next season's trials.
—PROGRESS REPORT, MAHA-ILLUPPALAMA EXPERIMENT STATION.

AGRICULTURAL SHOWS.

Very few Shows were held during the year chiefly owing to the fact that all the provinces of the Island participated in the big exhibition held in Colombo the previous year.

The Nuwara Eliya Show which is looked upon as an annual event (though there was no Show in 1913) was held on April 11th, 13th and 14th of this year and did not fall short of its usual standard.

A Show was also held at Matara on the 23rd, 24th and 25th June. As a display it was a great success, but from the Judges' point of view the collection of exhibits was not as good as it might have been. The Society offered medals for competition at both Shows.

A Show which was to be held at Kalutara in July has been postponed *sine die*—C. A. S. REPORT.

TOBACCO

OPERATIONS AT JAFFNA.

The outlook for tobacco grown in the Dumbara District is hopeful. The leaf is of a distinct type, originally introduced into the district over 40 years ago, probably by the late MR. ROBERT TYTLER, who brought with him experience of tobacco planting in the West Indies. It has now become adapted to environment and is extensively grown by the natives.

In June last, MR. B. SCHERFFIUS, the tobacco expert engaged by Government arrived, and lost no time in visiting Jaffna, Dumbara, Hanguranketa, North Matale and Kurunegala in company with the Secretary, and Chilaw with the Acting Organising Vice-President, with a view to studying the types of tobacco grown, the soils of the different districts, etc.

A few of the leading people of Jaffna have undertaken to place a tract of 10 acres of land at the disposal of the Agricultural Department for a period of three years, to enable MR. SCHERFFIUS to conduct the necessary preliminary trials; and it is expected that he will take up his residence at Jaffna in August so as to catch the coming tobacco season.

This land which is situated in Tinnevelly, within easy reach of Jaffna town, was selected by the Secretary at the request of the Director of Agriculture. The Government Agricultural Chemist to whom soil samples were submitted for examination has furnished the following report with his analysis:—

"The surface soil is a red sandy loam with only a little clayey matter which did not settle out after 24 hours' suspension in water. The mechanical state of division shows the soil to consist of particles that are about 25% medium fine soil, there being only 4% coarse sand and gravel. The plant food generally is poor, except in magnesia.

"The sub-soil is similar to above, but of a more sandy nature having less silt and fine soil, but more medium sand. The plant food is similar to above but has more potash and magnesia.

"There is nothing to indicate that the lands would not grow tobacco if the proper type were grown. It is suggested that several varieties be tried and the most successful chosen as the permanent culture.

"The lightness of the soil, due to the absence of clay and the small percentage of silt and fine soil accompanied by sands of coarser grain, suggested the growth of the binder and wrapper grade, if the overseers can be trained to look after the plants and control the fermentation. This grade is more difficult to grow successfully and economically than the filler which grows on the heavier class of soil with high rententive power for moisture, giving larger yields than the filler. The control of moisture on the lighter soils is important, else the leaf gets too fleshy for a wrapper, and can only be used as a binder or filler at a loss of profit."

The much-vexed question of what steps should be taken to tide over the difficulties in which the tobacco cultivators of the North find themselves at present owing to the depressed state of the trade with India, is at last about to receive attention at the hands of a highly-trained officer of considerable experience, who may be trusted to thoroughly study the question in all its bearings, and, if possible, find a practical solution.—C. A. S. Report.

ERRATUM.

In line 9, page 196 of the September issue of the Journal for "feet" read "deep."

CASTOR CULTIVATION IN CEYLON.

The extensive employment of castor cake as a manurial ingredient, apart from the use of the oil for lubrication and other purposes, is met by importations from India, though there is no reason why the plant yielding these products should not be grown locally on lands which are at present carrying no crops, such as the waste lands of the Wanni and Hambantota district. A trial plantation at Ambalantota yielded very promising results, and a quantity of seed has been sent to the Government Agricultural Chemist for examination and report of the oil-content. Mr. Bamber has a scheme for pushing the cultivation of castor oil with a view to securing a sufficient stock of seed to support a local crushing mill and thereby meet the large demand for cake for manurial puposes.—C. A. S. Report.

BALATA.

The export of this gum was a record one. The market for the article is not very elastic, however, and this, together with the low rates ruling for rubber, forced prices down to a low level. The exploitation of balata at present is scarcely remunerative, owing to the long distances over which the supplies for the expeditions and the gum have to be hauled, and the high cost of transport by ox cart and canoe, or pack animals. Balata trees are not bled like rubber trees, but are cut down. This procedure gives a larger immediate return, but as time goes on the collectors have to penetrate deeper and deeper into the forests, with the result that the cost of production increases every year. For these reasons the balata collectors are now turning their attention more and more to chicle (*pendare*), a gum extensively used in the United States as the basis of chewing gum. A diminution in the export of balata in 1914 may, therefore, be expected. The export of balata in 1913 amounted to 2,201,545 kilos valued at £414,688, against 1,686,337 kilos valued at £144,474 in 1912.—London Commercial Record.

FRUIT.

PROGRESS IN CEYLON

The work of the Society during the past 8 years in extending fruit cultivation is now yielding tangible results. This work was carried on chiefly through the distribution of seedlings raised in the Stock Garden, and grafted plants imported from abroad. The plants sent out aggregate many thousands, careful records of which have been kept. Letters often accompanied by specimens now reach the Secretary from different parts of the Island reporting the fruiting of these plants.

The change of environment in the case of new varieties introduced from abroad has not always proved advantageous : and this has been observed even where the change has been from one part of the Island to another. For instance the "Jaffna mango" of the wet low-country (which, strange to say, is known in Jaffna as the "Colombo mango") is a very different fruit from that found in the dry north. In the latter locality it has not merely altered its external appearance, but has developed a flavour which makes it one of the finest of our local types of mango.

It should be recorded that the grape-fruit raised from selected seed procured through the U.S.A. Department of Agriculture has fruited in the Island for the first time. This species of citrus which is so highly valued as a table fruit in the States and is botanically identical with our pumelo or shaddock or pamplemouse (Sin. Jambola), is only a variety evolved under special conditions. Even in Ceylon the types of pumelo in some localities are much superior to those in others, and are quite as good as the grape fruit in flavour. Reporting on a sample of the latter from Mr. K. B. Beddewela's property in Kandy, Mr. H. F. Macmillan, Superintendent of Botanic Gardens, says :—"It is a fine specimen indeed, comparing well with those usually seen in Covent Gardens. The flavour is, in my opinion, well up to the mark."

Of the imported plants of the seedless Siam pumelo only a very few have survived. A specimen of this fruit received from Singapore was so entirely free from acid, as to be flavourless.

Among the low-country products the plantain (banana) has been attacked by some obscure form of disease which is very prevalent in the Colombo district. On its being observed at the Stock Garden, where the representative collection of plantain varieties has been practically killed out, the matter was reported to the Mycologist who from time to time inspected the diseased plants and secured specimens for examination. A leaflet on the subject written by Mr. Petch was issued last November by the Society. Experiments made by him appear to indicate that the spread of the disease from one plant to another is slow, and provided this is correct, there should not be much difficulty in getting rid of it. He warns growers to be on the alert, and as soon as the disease appears, to take steps to

eradicate it by burning the affected plants, while the place where they were grown should be liberally treated with lime and forked over. If the plants cannot be burned they should be cut in small pieces and buried 2 feet deep with a kerosine tin full of lime. Plantains should not be grown on infected land for some years, and in procuring suckers for planting new lands, infected areas should be avoided.—C. A. S. Report.

FRUIT AND VEGETABLES AT PERADENIYA.

There is a fine show of vegetables in the fruit plots at present Egyptian beet-roots (which do the best of all the best varieties), carrots, leaks, onions, cucumbers, artichokes, beans, and lettuce being specially fine. Tomatoes are coming on well, but as is usual during the wet weather the young plants have been attacked by the withering disease (Lacillus solanacearum). The Australian orange trees which were not doing well and subject to both scale and fungus attacks, have been cut down and grafted, under the supervision of Mr. Parsons, with scions from our own lemon trees which bear good fruit and with orange and tangerine scions obtained from Mr. K. B. Beddewela, Maligatenna Estate, Kandy. But none have taken either owing to the unsuitability of the method employed (bark-grafting) or of the season. Another attempt will be made later on.

Small beds have been sown with various grains from India.

Nurseries have been made of the various fibre plants required for the new economic plots.—Progress Report, Peradeniya Experiment Station.

MANURING FRUIT TREES.

VALUE OF MIXED MANURE.

For maintaining fruit trees in bearing, in health and vigour, and enabling them to bear heavy crops of fruit, it is essential that they be properly nourished.

In practice, this is generally ensured by application of fertilisers.

In order to better understand the subject, it is worth the fruit-grower's while to unearth this knowledge himself, in his own orchard.

There are three ingredients which need to be furnished through the medium of fertilisers—namely, potash, phosphoric acid, and nitrogen. The remaining essential plant food constituents are usually present in the soil in abundant quantity, and need not be supplied. Adverting to these three important constituents, it is generally safer, when the fruit grower is not properly conversant with the tree's requirements on his particular land, to apply all three. A one-sided manuring is not a profitable manuring, and is not productive of the best results.

In order to ascertain the requirements of fruit trees in his orchard, the fruit-grower is recommended to experiment; in other words, manure certain rows of trees in the orchard with different manurial dressings and closely

observe the results with regard to yield, size, colour, appearance, flavour, and keeping qualities of the fruit produced, and also the appearance, vigour, and disease-resistant properties of the trees, and, not the least important, the profits accruing from their application.

The beginner should remember that potassic fertilisers supply potash phosphatic fertilisers, phosphoric acid; and nitrogenous fertilisers, nitrogen respectively.

Examples of potash fertilisers are—

Sulphate of potash, and
Muriate of potash.

Those of phosphatic fertilisers—

Superphosphate,
Basic Slag, and
Bonedust,

the last named also supplying a little nitrogen, while

Sulphate of ammonia and
Nitrate of soda

may be cited as examples of nitrogenous fertilisers.

Supposing a fruit-grower is desirous of ascertaining whether fruit trees on his land will respond to potash, all he need do is to apply phosphatic and nitrogenous fertiliser to a number of trees and make a note of it. Such a dressing is known as an incomplete fertiliser, as it does not supply all the three important plant food ingredients. To an equal number of trees of the same age, variety, and size, on similar land, he should apply the same amounts of phosphatic and nitrogenous fertiliser, plus, say 1 to 2 lb. sulphate of potash per tree.

Similarly, if a grower desires to find out if it will be profitable to apply phosphatic or nitrogenous fertiliser, he may proceed on similar lines, omitting the particular fertiliser which he needs the information about from the dressing, in one case, be it phosphatic or nitrogenous, and including it in another. In this way the fruit-grower may observe the behaviour of the trees towards the particular kinds of fertilisers.

Fruit crops are unlike most farm crops, in that the effects of fertilisers are not so readily observable, and the beginner needs to be warned against expecting outstanding results the first season. The second and subsequent seasons, however, good results may follow rational manuring.

Mr. Alfred Thiessen, of Geeveston, Tasmania, laid down experiments on the three-plot system in the spring of 1912 with apple trees. The trees on the No. 1 plot were left unmanured, those on No. 2 received :—

3 lb superphosphate
2 lb. bonedust
½ lb. sulphate of ammonia
1½ lb. sulphate of potash

per tree, and those on No. 3 received

3 lb. superphosphate
2 lb. bonedust
½ lb. sulphate of ammonia.

The yields, calculated per acre, for the first season were :—

Plot 1, 560 cases
,, 2, 800 ,,
,, 3, 666⅔ ,,

The past season's results (being the second year of experiment) were :—

Plot 1, 524½ cases
,, 2, 1,022¼ ,,
,, 3, 915 ,,

The absence of fertiliser on plot 1 accounted for considerably lower yields. The trees on plots 2 and 3 each received the same amounts of superphosphate, bonedust and sulphate of ammonia. Those on plot 2 were given 1½ lb. sulphate of potash in addition.

The difference in yield, and consequently the money value, between the two plots was well marked, and showed that the complete fertiliser was the most profitable one.—THE FRUIT WORLD.

A BANANA DISEASE.

The disease attacking the bananas has spread considerably especially in the low-lying plot near the river, which looks as though wet soils encouraged it. It seems to confine itself to the varieties of Suwandel, Kolikuttu and Alukehel. MR. BRYCE, the Assistant Mycologist, states that it is attacked by *Fusariam*. The disease shows itself first on the leaf margins and soon kills the whole leaf, turning it a bright yellow. From thence it soon proceeds down the leaf-base to the bulb. There it spreads across the insertions of the other leaves, hence the yellowing of young leaves simultaneously over the whole surface. All leaves showing any sign of the disease are being at once cut off and either burnt or buried: the roots of diseased stems are being cut out and buried with quicklime, in the hope of checking the disease.

Some interesting data is being collected with regard to the flowering and fruiting periods of the different varieties and the size of their bunches.—

PROGRESS REPORT, PERADENIYA EXPERIMENT STATION.

TOMATO GROWING.

The tomato, being a gross feeder, the soil in which to grow it can hardly be too rich, especially in lime, potash, and phosphoric acid. A perfect tomato soil is a rich sandy loam, well drained, deeply dug or ploughed, and subsoiled. Sow the seed in August or September ; and when the plants are about 6 in. high, thin them out to about 3 ft. apart, and put up a light trellis to train them on.

The plants which have been taken out may be planted in some other part of the garden. Before planting out, clip all the leaves off except the top bud. The plants so treated will start to grow immediately, because they are not obliged to expend their energy in trying to revive the dying leaves. The plants will bear a month earlier.

When the first fruit forms, stop the plant by pinching off the ends of the shoots.

A very good plan to train tomatoes is to erect a framework of hardwood pegs, 18 in. above the ground, nail hardwood battens on the top, and stretch wire netting across it. The young vines must be properly guided and trained through the meshes, and not be allowed to fall back again. When the vines are full grown, the top of the netting is a complete mass of fruit and leaves, and all the fruit is clean.

Tomatoes may also be trained on stakes. As soon as the planting is completed, a split stake, 5 ft. in length, is firmly set at each plant, and about the time the fruit is setting each plant is tied with common cord. The string is tied round the stake, and loosely about the stem of the plant, so as not to interfere with its growth. Care must also be taken not to allow the fruit to cluster, so as to run against the stake.

The sprouts or auxiliaries will grow very rapidly, and must be constantly pinched off. Three tyings are usually necessary up to the time when five good clusters of fruit have set. When these aggregate 20 or 25 tomatoes, the top is pinched off, and the whole strength of the plants is centred in the production of firm, bright, smooth tomatoes, of good and uniform size. Pinching back the suckers tends to increase the size of the leaves, making shade for the fruit. Constant systematic pruning forces the plant into bearing; therefore, carefully remove all suckers.

Tomatoes mature in three or four months, according to the soil, season, and climate.

Manure for Tomatoes : It is a prevalent idea that the tomato will not stand heavy manuring. This is only true of the crop after the fruit has set. In the early stages of development, nitrogen, phosphoric acid, and potash may be liberally supplied with advantage, but, after the fruit has set, manuring with farmyard manure or other stimulating fertilisers delays the development and ripening of the fruit.

A good manure is made up as follows :—

2 parts of nitrate of soda,
2 parts of bonemeal,
3 parts of kainit,
4 parts of superphosphate.

Of this mixture, 1 oz. per square yard of soil may be applied weekly, from the time that the plants are established till the fruit has set. Superphosphate has been found to hasten the maturing of the fruit.—Queensland Agricultural Journal.

PAPAW PLOT AT GANORUWA.

A half-acre plot of papaws both the round and oblong varieties has been planted 6 by 6 feet, behind the store. The object is to obtain some more figures on papain. This plot was in a very bad state of Cora grass (*Cyperus rotundus*). Two varieties of large-leaved sweet-potato (*Ipomea batatas*) were planted thickly between the rows of papaws, with the object of smothering

out the Cora grass. This has been successfully demonstrated in small beds in the fruit plots, where the vines have completely smothered out the grass, but it is too early yet to say whether or not the grass will come up again after the vines are removed.—PROGRESS REPORT, PERADENIYA EXP RIMENT STATION.

FACTORS INFLUENCING MANGO CROPS.

MR. A. C. HARTLES, F.R.H.S., Superintendent of the Government Botanical Gardens at Saharanpur, contributes to the current number of the AGRICULTURAL JOURNAL OF INDIA a useful article on the subject of mango crops, and some factors influencing them. The importance of the crop to India is, he says, such as to warrant investigation into its periodicity. Unfortunately no reliable statistics for the whole of India, are available to illustrate this point. The records maintained in the Government gardens at Lucknow, Nagpur and Saharanpur, which are summarised in the article, go to show that the malignant influences which affect the mango crop are : (1) Blight (due to insects), (2) Frost, (3) Heat and dry hot winds at the time of flowering, (4) Cloudy weather, excessive humidity, rain, and storms during the flowering period and (5) Exhaustion following a heavy crop. Of the five causes of failure, four are external and one may be called internal or inherent to the plant. Of the four external agencies three are climatic, and therefore practically beyond control, but the last is open to be controlled. The observations of MR. HARTLES on this last factor permit of quotation.

EXHAUSTION FOLLOWING A HEAVY CROP.

The above is one of the causes given by more than one recorder. We may really call it the law of alternating fruit years. This is so well recognised amongst the cultivators, that it is always taken into consideration when selling the crop which is usually done before the mango flowers. If this law was the only factor influencing the mango crop, we would no doubt have good years and fair years, in regular alternative succession. This law of alternation is recognised in fruit culture generally, especially in apples and pears.

I have elsewhere partially discussed the important question of alternating fruiting years, but its importance is a sufficient reason for again referring to it in some detail.

BAILEY, in his book, "The Principles of Pruning," lays down a law that —" Fruit bearing is determined more by the habitual performance and condition of the plant than by the kind or extent of pruning. It is associated with a quiescent rather than with a stimulated or fitful state, and the habit is more amenable to treatment when the plant is young than when it is old." Under normal conditions it is natural that plants should fruit equally every year. Anything however that disturbs the ordinary equilibrium of the plant's life would react on the fruit bearing habit. Some of the factors that may be responsible for such a disturbance have already been discussed. But there are many others, incidental to plant life, that would also have the same effect.

One important factor in this direction is overbearing. Bailey says "overbearing is itself a disturbance of equilibrium, and is almost necessarily followed by a reaction or underbearing. This corollary has such an important bearing on practice that it should receive careful attention. One extreme follows another, and the oftener these extremes occur the greater is the likelihood that they will become an unremediable or fixed habit of the plant. It is interesting to note that the habit of alternate bearing is most pronounced in plants of long life, suggesting that the habit is largely, if not wholly, the result of the frequent occurrence of over-bearing while the plant was young.

Gorr, in an article in American Gardening on the "Origin and Development of the Apple Blossom," gives some interesting suggestions which may equally be applied to mangoes. He says that leaf and flower buds are in a measure interchangeable. By proper pruning a flower bud may be converted into a leaf bud, and by ringing, a leaf bud may become a flower bud. Flower buds may be many years old before they form flowers. Any restriction of the movement of prepared food in the branches, such as is caused by ringing, or by a wrinkling of the bark formed by the union of the fruit spur with the branch which supports it, tends to the formation of flower buds. Dry weather is also conducive to the formation of flower buds, since during such a period evaporation through the leaves is rapid and sap becomes concentrated and rich in prepared food. Flower buds are then formed in portions of the tree where there may be no restrictions of the movement of the sap, as at the end of young shoots, etc. Whenever the water supply is increased the tendency is to wood-growth, and the formation of leaf buds. A normal growth is accompanied by a normal formation of flowers. When the fruit spurs of healthy trees push into growth or sap-sprouts start freely from the old wood, growth is abnormal and fruit production is postponed. Investigations show that as active wood and leaf growth ceases, the formation of flower buds begins and may continue until cold weather sets in. During very favourable seasons for the formation of flowers all the 1-year, 2-year, 3-year old buds, many older buds, and some buds formed during the year, may form embryo flowers. This explains why an excessive fruit crop is always followed by a scanty one.

The above conclusions drawn from investigations on the apple apply equally to the mango. To illustrate the plausibility of the assertion that flower and foliage buds are interchangeable, I have seen cases in the mango which show great irregularity in the differentiation of flower and leaf buds. In some cases, foliage leaves were intermingled with the flower branches of the inflorescence, in others, foliage leaves had developed at the end or apex of the inflorescence. In the latter case although fruit may set, yet it usually does not develop. It would appear that weather conditions have a predominating influence, especially at about the end of the monsoon. The finest year for mangoes that I have seen followed an early closing of the monsoon. There is therefore some reason in the saying that what is good for a bountiful mango crop is not good for agriculture generally. This has been physiologically explained in the summary of the article by Goff, previously quoted. In the case of trees that are amenable to pruning, the alternating effect of an exceptional year can be controlled to some degree, by this practice, but in

the case of an evergreen like the mango, this is not feasible. The only alternative therefore is the thinning of the crop. What takes place in the mango is similar to that of the apple only that a terminal shoot takes the place of the spur of the apple. It is simply a question of conservation of the energies of the tree. The demands upon a shoot when bearing a fruit are so great that another fruit bud cannot develop the same year, what follows is, that, immediately after fruiting, some short shoots start from below the fruiting stalk. These are generally in a cluster around the end of the fruiting shoot. They develop more or less, according to the season, during the same year as the shoot flowered. The succeeding year, these shoots, or some of them, develop further and continue growing until checked by the closing of the rains. If dry warm weather follows, these shoots ripen or mature, and flower buds form. If, however, moist weather continues until the cold weather arrives, these shoots still continue to grow, and produce no flower buds ; and it is this latter contingency that is to blame for some conspicuous "failure" years. This particular contingency is probably beyond our control, but the effects of the law of alternative fruiting years, which no doubt influences all the disturbing factors discussed, can be modified.

1. Thinning the crop is the most obvious method. But to be effective all the fruit or better, the blossoms from selected shoots must be removed. This would induce such shoots to start at once into growth with a possible chance of being developed and matured that year.

2. Thinning out the shoots of the growing year would throw more strength into those left. I have already explained that at the growing period of a shoot a number of young shoots are thrown out, below the fruit, it is to these shoots I refer particularly.

3. Some branches remain non-fruiting for some years. It is possible that a judicious heading in some of these yearly would induce stronger growth to take place, followed by fruiting the following year. The mango is, as we know, not amenable to much cutting, but can stand a little, and this may be taken advantage of in the way suggested.

4. In the case of large orchards, some trees may be altogether deprived of their flowers. This would induce them to alter their fruiting year, so as to have some trees bearing every year.

5. Lastly, as the whole question is chiefly that of food supply, every endeavour should be made to keep the trees in as healthy a condition as possible. As a rule the mango, after it once begins to bear, gets little or no attention beyond watering. Much has yet to be learnt about providing additional food materials. There is no doubt that good tillage and some judicious manuring would contribute largely towards enabling the exhausted trees to recoup themselves annually instead of biennially, as is now the case. But it should be remembered that although such means as above suggested may change or help to change the alternating fruiting year, yet it is also true that the trees tend to revert to their accustomed habit, and it is probable that this reversion is the more rapid and the more complete the older the tree, and the more indifferent the general treatment of it.—Agricultural and Co-operative Gazette.

APICULTURE.

HINTS ON BEEKEEPING.

A. P. GOONATILLAKE.

As a rule bees do not sting without sufficient reason. They use their sting in protecting their stores or when they are hurt or needlessly irritated. Some stocks are much less excitable than others, the former being generally those found in places frequented by people or whose hives are examined often; hence bees kept in modern hives are as a rule gentle. There is reason to believe that bees are more excitable at some seasons. They are generally mild during the honey-flow and excitable when honey is not forthcoming. They are also vicious when robber bees are at work. During the rainy seasons they appear to be less prone to sting and less active, but during warm weather the reverse. Some beekeepers are so awkward when examining a hive that they cannot take out a frame without jarring it, while others are so timid that they tremble all over when examining the hive. Such persons should not blame the bees when they are stung. It is people of this disposition that speak of beekeeping as a dangerous pursuit and instil fear into the minds of others. When frightened or excited, bees gorge themselves with honey so that a beekeeper may lose much by his indiscretion. Hives are best examined when the workers are busy, i.e., between 7 and 10 a.m. If those left in the hive show any signs of anger they may be effectually subdued with a puff of smoke preferably from a cigar, care being taken not to unnecessarily harass the young bees by smoking them too much. With experience, however, it is possible to avoid exciting the bees by slow and steady handling. In manipulating the frames great caution should be exercised as a comb may break down and the bees attack you. Bees alighting on the body should be allowed to fly away and on no account be forcibly driven off. Those found on a comb may be shaken into the hive after a little smoking. To do this hold the comb vertically over the open hive and give it a smart downward jerk, or hold it with the right hand and give the back of that hand a smart blow with the left hand. If some of the bees still remain on the comb they may be shaken a second time or blown off into the hive. They should not be allowed to drop on the ground as most of the young bees will be liable to be lost. They may also be brushed off with a bee brush or a stiff goose, turkey or peacock feather, though this is apt to irritate them. In some instances smoke will have to be used plentifully, as in uniting two stocks, going to the rescue of fighting bees, transferring frames, extracting combs of honey from an unusually vicious colony, etc. Avoid crushing bees as the resulting odour excites the rest to sting. An experienced beekeeper knows when bees are inclined to be vicious. The note of warning given by the Italian bee is so characteristic that it can be discerned by a beginner. When thus warned, the beekeeper should step behind the hive and remain still. Do not expect to avoid being stung by fighting the bees or even by attempting

to run away. In examining a hive always stand on one side, and not in front of the entrance, because the incoming and outgoing bees are irritated by your blocking their way. When a bee stings it leaves its sting in the flesh and if you try to pinch it off you will probably compress the poison-bag and inject more poison into the flesh. To remove a sting scrape it off with a blunt knife or the thumb nail. The poison in the sting is considered to be a remedy for rheumatism: and extraordinary stories are related of the efficacy of bee-stings for this and other ailments. In one instance a case of blindness is said to have been cured by bee-stings in the region of the eyes. Those who are repeatedly stung often become immune to pain. If a bee-sting is very painful a hot fomentation is advisable; other remedies are alcohol in some form, ammonia, salt, infusion of chillies, tobacco juice and laudanum.

As one gains experience he can handle bees with impunity without the aid of veil or gloves. Before examining a hive see if the roof is glued down to the edges of the hive, or the frames to one another. If so, hold the roof with both hands and raise it gently but firmly towards you until the attachment gives way After putting away the roof try to loosen the frames by pushing them one by one away from each other; then gently lift up the frame you desire to examine, holding it with both hands by its ends. If there is not sufficient room in the hive to move the frames easily, try and get out any one frame and after placing it on the alighting board against the hive body proceed to take out the frame you want If the hive is not full of frames push back the dummy until it is possible to easily remove the frames. When taken out, frames should be held steadily with both hands and examined on both sides by turning them without removing the hold. In examining frames hold them vertically or they may break owing to their own weight Look out for the queen, you may be able to observe her laying eggs, and it may be possibe to see young bees being hatched out, the larvæ being fed, honey and pollen being stored in the cells, and so on. All irregular and unnecessary growths on the comb or frame or body of the hive should be removed. After examining close the hive as gently as it was opened.

INTERNATIONAL CONGRESS OF TROPICAL AGRICULTURE, 1914.

This important Conference was held in London last month. At a meeting of the Board held on February 3rd, it was decided to vote a sum of £10 towards the cost of printing and publishing the proceedings of the Congress, and to appoint as delegates Dr. H. M. Fernando and Mr. W. A. de Silva. The following papers were contributed from Ceylon :—

The Principles of Hevea Tapping as determined by experiment, by T. Petch.

The Diseases of Hevea in Ceylon, by T. Petch.

The Fixed Oils of Ceylon, by Frederick Lewis.

The Progress of Native Agriculture in Ceylon, by C. Drieberg.

The Prospects of Dry Farming, by C. Drieberg.

Fruit Cultivation in Ceylon, by H. F. Macmillan.

—C. A. S. Report.

POULTRY

BACK YARDERS.

G. E. INGHAM.

Back yard poultry keepers, as a rule, fail to take advantage of the good things (essential to poultry) that are easily within their reach. Peat moss litter, for instance, is largely used in towns and suburbs, where most back yarders reside, owing to its deodarising qualities, and by a little judicious inquiring may be obtained at a very trifling cost, and in some cases for nothing, if they will take it away, from dairymen and horsekeepers who use it for stables, bedding their horses on it. It is very suitable for scratching sheds, especially if whole corn, such as wheat, barley, and oats, be mixed with it liberally while it is fresh, as it tends to sweat and generate bottom heat, and any corn buried for some time quickly sprouts, and is highly relished by back yard poultry. It should be from 12 to 18 inches deep to do any good, as then the fowls have something to work in, and do not find all the corn in a few minutes, as they do where 2 or 3 inches of chop, cut straw, leaves, or shavings are used. Above all things the shed must be water-proof, and what with the fowls scratching it up, and the turning of it over to put corn in, it will be dry enough to put in the roosting house, 6 inches deep, in a very short time. After it has been used up in this way it is excellent material for the farmer or market gardener. It keeps the fowls off the damp, cold ground, and is warm to their feet, which is a great factor in the production of the winter egg. It is also an excellent thing for the chicken pen, as it keeps sweet and absorbs the droppings much better than soil, which back yarders, as a rule, find it very difficult to obtain. Another excellent thing, for town poultry keepers, which I have never seen advocated in any poultry paper as yet, is banana leaves, or packing. Leaves from the banana tree are largely used to pack the fruit in the cases in which they are brought over to this country. Any fruiterer will be glad to give them away. As they are sometimes a yard long, and very strong, they are inclined to get ropey, but if cut up while new they make excellent and lasting scratching material, cut about 9 inches or 1 foot long. On the top of the peat moss they get worked in; and add density to the lot, which prevents the fowls going through it and finding all the corn so quickly. It really makes more work, and that means more eggs. Banana leaves are good to use by themselves, as they are so large and strong; if put down about 1 foot deep the corn thrown amongst them is soon buried and needs no turning in, and the fowls are almost buried while scratching for it. Above all it must be kept in a dry place, and as it is so easily obtained no town poultry keeper should be without it. Back yarders are somewhat handicapped to supply green food, but there are several ways to get over this difficulty. Waste leaves from the fruiterers, both cabbage and cauliflower, are plentiful at times, and should be arranged for. A rack or large net pocket should be made at one side or corner of the run, after the style of a horse's hay rack; use 2-inch netting and toss the leaves in; they

will peck through the mesh, and the leaves will be kept clean. This is much better than tying them up, and you can deal with a larger quantity. Another way is to procure some wheat screenings (most town or corn dealers sell them) and mix them with soil or ashes; in a short time they sprout and are enjoyed immensely by back yard fowls; it is as good as putting the fowls in a garden. Good screenings consist of wheat, broken wheat, bastard buck wheat, rape, turnip, mustard, linseed, etc. Another thing which is generally overlooked is the necessity for clean feeding. Small runs continually occupied by fowls soon get tainted and insanitary, so that it is not wise to feed fowls with soft food on the ground. A good and clean way to feed it is to procure a tub, butter or margerine will do, and cut spaces out with a lock saw, 10 inches long and 3 inches wide, leave an inch of timber between, and an ordinary size will feed 9 or 10 fowls at once. Cut out 6 inches from the bottom and 2 inches from the top ; a lid to overlap 2 inches can be made from the top of a larger tub, so that the rain will run off. This is an easily made and cheap feeding arrangement. As the fowls feeding in the open get wet in bad weather, procure an old door and hinge it to the side of pen to fall like the leaf of a table, with a prop hinged to support and double under; a temporary shelter is thus afforded which can be easily dropped or raised according to the weather, and does not take up room. It also provides a dry footing, where otherwise there would soon be a puddle.—Feathered Life.

HOW TO TRAIN BIRDS FOR SHOW.

Unless a bird has received a proper training—no matter how well it may be benched, in nine cases out of ten that exhibit will not be placed high in the honours list. If a show bird is wild in its pen when the judge is attending to that class, it will not be looked at.

Some exhibitors seem to think that the judge has all day in which to make his awards, but this is very wide of the mark. At most one-day shows the judge has to get through his work in a short space of time, so that the gate can be thrown open to the public at dinner time. The training pen is not the only means of taming a show specimen. Much can be done in this direction when the birds are young. The exhibitor who pets his young stock and takes a great interest in the birds till they are matured will be sure of having his birds docile by the time they are required for show.

It is up to every would-be successful exhibitor of prize fowls then to be often with his young stock, giving the most promising ones tit-bits from the hand. This is not a laborious undertaking, for he need only pay attention to the prize specimens he has culled from his flock of youngsters.

Training pens can be purchased very cheaply from the various makers of poultry appliances. The length of time before a show that this training should be commenced will depend to a great extent upon the temperament of the bird. A fortnight before the show would not be too soon for some birds to be placed in the training pen, whilst others would be satisfied with from seven to ten days. Again, whilst the training pen should be large enough for its occupant, it should not be too roomy, or it will take

longer to train the bird. Some breeders use two sizes of pens. The birds are placed in the larger pens at first, so that they will not damage their plumage should they try to perform acrobatic turns. When they have settled down they are transposed to the smaller or ordinary sized pens.

OBSERVE UTTER CLEANLINESS.

During the whole time that the bird is in the training pen utter cleanliness must be observed. The droppings should be cleared away daily and some fanciers use sliding bottoms to their pens to facilitate cleaning operations. A movable perch is placed inside the pen for the occupant to perch upon during the night. The last thing at night the sliding bottom to the pen is removed, revealing a false bottom of wire netting, through which the excreta drops. In the morning the wooden bottom is put into place again and the perch removed.

When the occupant is being trained the owner should feed it with choice tit-bits, and after stroking the bird gently with a judging stick or cane, it will not be long before the bird will allow its owner to take it from the pen and stroke it. The latter process can take place whilst the bird is positioned on a box near the training pen.

To keep the pen clean it is a common practice to put a sprinkling of sawdust or dry sand on the bottom of the pen. The occupant will require a constant supply of fresh water to drink, and as regards feeding, it is unwise to change the diet suddenly, as this is apt to throw the bird off its food. Milk can be given to drink as a change. Where a male bird goes off colour whilst being trained, he will soon brighten up if a hen is placed with him in the training pen a day or two before he is to be despatched to the show.—

Poultry World.

BREEDING TURKEYS.

The first step for the beginner who takes up turkey breeding is to commence with healthy, robust stock as the foundation of his future work. It is necessary that the parent stock should have reached a certain stage in their growth before they are used for breeding. This matter rarely receives the attention that it deserves, and much of the turkey's delicacy and the number of weedy chicks that one sees on so many farms are due to the fact that too young birds are used for stock purposes. I prefer using two-year-old hens, and the male bird may even be a year older. At these ages both sexes are in prime breeding condition. It is necessary that both should be large, since size is of the utmost importance, and it must be remembered that large chicks will never be bred from small parents.

TREATMENT FROM THE TIME OF HATCHING.

The natural time for birds to lay is in the spring of the year, and turkeys are no exception. Eggs may be expected in March, and hatching should commence forthwith; the first batch of eggs may be given to ordinary hens, and when the turkey has laid as many eggs as may be expected for the season, she will probably become broody. If she receives proper care and attention she may safely be allowed to sit, and will, in due course, make an excellent

mother, capable of brooding 15 or 16 youngsters. She may be set in a box similar to that used for the hatching of ordinary chickens; but, of course, considerably larger. The time required for hatching is 28 days. When all the chickens are hatched and thoroughly dry, they should be removed to a large coop or crate. Their removal from the sitting box should not, however, be unduly hurried, as is sometimes done. Every hour that they remain under the hen—that is of course, within a reasonable time—they are gaining strength. Turkey chickens do not require feeding until they are 24 or 30 hours old. The food for the first five or six days should consist of hard-boiled eggs, chopped fine, mixed with biscuit meal or stale bread crumbs, and slightly moistened with milk. The egg food should be left off gradually, giving in its place a cooked food mixed with rice boiled in milk. When ten days or a fortnight old a little dari, groats, or buckwheat should be thrown down, and, most important of all, young onions finely chopped should be provided. All kinds of tender green food are useful, but meat, minced and mixed with the soft food for the first three months, is absolutely imperative. With this one exception, the same foods as used for the other poultry may be given to the young turkeys. It is necessary that they should be fed at frequent and regular periods, for unless this is done they are almost certain to suffer from indigestion. Young turkeys have only a very limited capacity for consuming much food at a time; hence the advisability of giving a small quantity of food, and this at frequent intervals. They should be fed five times a day for the first five or six weeks.

When the chickens are a fortnight old, barley meal or ground oats, mixed with middlings, can be given in the place of the soft food that has been used up to this age. Small wheat may take the place of the groats. This method of treatment may continue until they are about eight weeks old, when they are past the very delicate stage, and have reached an age when they may be removed from their coop. The treatment from this period onwards is not a difficult one, since they can partake of the same food as the other poultry, and they will take readily to roosting either in trees or in a house, according to the situation of their rearing ground.

FATTENING.

Upon farms where there is arable land, full advantage should be taken of the stubbles, and the turkeys may be allowed to run thereon as long as possible. They are excellent foragers, consequently they obtain a very large proportion of their food. This, however, is not the only benefit, since the birds gain by this method of treatment to a considerable extent during these few weeks' liberty, before they are eventually fastened up for the final preparation before being killed for the Christmas trade. After the stubbles, they may run on pasture land until about five weeks before Christmas, when they should be shut up in a large open-fronted shed. The feeding should now be of a fattening nature, and for this purpose there is nothing to equal ground oats, which not only puts on flesh very rapidly, but gives it a whiteness which considerably adds to its appearance. Barley-meal or wheat-meal is also extensively used. Whole wheat or oats, steamed or boiled, may be given in the evening. During the last week a little pure fat, say, half an ounce per day per bird, may be added with advantage to their soft food. This just puts on the finish that is so necessary if the birds are to realise the high prices which are so well maintained every Christmas.—Feathered Life.

POULTRY NOTES.

"Seasonable Work for Poultry-keepers" is the title of an article contributed by James Hadlington to the Agricultural Gazette of New South Wales from which we take the following :—

BROODY HENS.

When it is desired to get as many broody hens as possible, the nests should be made snug and secluded, and the laying hens should be disturbed as little as possible, and one or two dummy eggs should be marked and left in the nests. The object of marking them is so that they are not gathered with the daily collection of eggs. These dummy eggs and the seclusion will induce the hens to stay longer on the nests when there is the least tendency to broodiness, and consequently they go broody sooner than would be the case if the opposite conditions prevailed. When the hen is found to be broody she should not be transferred to a new nest for a couple of days at least, in order to allow her to become thoroughly broody before any transference is made ; otherwise but few hens will take to a new nest, especially in cold weather, when broodiness has less hold upon them than in warm weather.

SETTING A HEN.

There are many ways of making a nest for setting hens, and a notion prevails that it should be made upon the bare ground, and a hollow scooped out of the earth to form a mould in which to build the nest. Undoubtedly this is a natural way, but it is not always practicable under all conditions, and in any case, is not necessary. Equally good hatches are brought off nests that are raised from the ground altogether, and the notion that the moisture coming up from the soil is necessary to successful hatching, is an exploded idea. The nests can be made, and equally good results obtained, everything else being equal, by using a box with a bottom in. A very good size for a nest-box is 15 inches long, 12 inches wide, and 5 inches deep. This should be enclosed on three sides and top, and if necessary darkened in front, and set in a small shed, or some such position. Short-cut, pliable straw, or some such material should be well padded into concave shape round the nest, and sufficient material left on the bottom to bed the eggs properly. It is a good plan to sprinkle a little powdered tobacco leaf through the nest, in case of vermin.

KEEP THE HENS CLEAN.

The greatest drawback to sittting hens is their liability to vermin. Everyone who has had even a little experience will understand this ; but it is but few who realize the source of all the trouble, and take steps to obviate it. One frequently hears complaints of sitting hens becoming badly infested within a week from being set ; but when this is the case, the cause is not far to seek. It lies in the fact that the house from which the hen was taken was first infested, and the infection carried to the nest. The moral is, "Keep the poultry-houses free from lice some time before setting hens are required, and much less trouble will be experienced in this respect with the sitting hens." How to do this has already been indicated in these notes ; in short, it is the hen house that is the focus of the whole trouble.

Where many hens are required to be set, the nests can be placed around the floor of a shed, if proper supervision can be given them ; but a much better plan is to have a small run for each nest, and feed and water provided in each. In this way much less attention will be needed, and better results be obtained than from the above plan, owing to the absence of fighting and changing of nests, with its consequent casualties.

ATTENDING TO THE SITTERS.

The water-vessel should be placed in a convenient spot, and never allowed to become empty. If a hen becomes over-thirsty she will invariably break one or more of her eggs, and attempt to supply the deficiency. Feed should either be placed in quantity before her, or feed supplied at a regular time every day ; grain only being used. Regular daily visits should be paid by the attendant to the nests to see if the hens are coming off the nests for feed and water, and other services, after the first forty-eight hours, and if not, they should be gently lifted off the nest and allowed to feed and exercise from ten to twenty minutes in the early stages, and later on thirty to forty minutes will not harm them, but will be beneficial to the eggs. A dust bath of dry earth or ashes, into which a handful of sulphur has been thoroughly mixed, should be provided in the run ; but not too much sulphur, or the fumes will be harmful to the embryonic chick. When several hens are set at a time, it is a simple matter to divide the chickens up between a portion of the hens, and re-set the balance for a second term if hens are scarce. Eggs can be started under hens and transferred to an incubator after the first week, if desired. This is an advantage when incubating eggs which are over a week old when set.

ARTIFICIAL INCUBATION.

As a general rule my advice to beginners using incubators is to follow, as closely as possible, the manufacturer's instructions for operating the particular machine they are using. However, I might supplement these on some points. The first is in regard to the regulation of the machine to meet extremes of temperature, one way or another, and one point that incubator manufacturers might be more explicit upon, is to how to meet these. I am frequently told by beginners of their getting up at all hours of the night to attend to the incubator. This should be absolutely unnecessary with any standard make of incubator worked under normal conditions, and the whole trouble, in almost every case, is regulation of the machine, or failure to anticipate coming temperatures. Thus, if a cold night follows a hot day, judgment has to be brought to bear upon the adjustment of the machine to meet the lower temperature, and even though the incubator be running the exact temperature required, it should be altered equal to registering another one, two, or three degrees more, according to the intensity of the change expected, if the machine is to be found at the right temperature the next morning. This adjustment is done first by giving a little more light, and secondly, by a turn or two of the thumb-screw, which on most machines regulates the balance ; but in no case should the permanent balance of the machine be disturbed. The same also applies to anticipation of a hot day succeeding upon a cold night ; the regulation needs altering in the reverse way, and well in advance of expected changes of temperature. Another

point is the proper trimming of the lamp. If the wick is allowed to become incrusted or otherwise dirty, imperfect combustion will be obtained, and the lamp will smoke, resulting in the formation of soot, which, if it falls down upon the light, will most likely cause a fire. When all this is properly understood, there should be no necessity to attend to the incubators between turning the eggs at night and early next morning.

Eggs for artificial incubation should be under a week old when set, because it is found that the chances of a successful hatch diminish with the age of the egg. Eggs will invariably hatch fairly well, even up to three weeks old, with hens if care has been taken with them. This can be done by standing them, large end downwards, in bran or sawdust, keeping them out of draughts ; or entirely covered up, and turning occasionally after they are a few days old. Eggs kept so long should not be shaken or jarred in any way.

VALUE OF LIME AND CLEANLINESS IN SMALL RUNS.

Lime, without doubt, is very valuable to poultry keepers, and all runs that have got rank through constant use by the stock can very easily be got nice and sweet again, with the constant use of lime sprinkled on the ground every day. Another plan that has been successful is to dig up the ground and mix lime as thick as possible and bang down as hard as possible, when the lime will kill all germs and you will have the ground in grand condition. There are a number of back-yarders who get their runs and houses in filthy condition through constantly throwing greens and other foods through the wires. The stock do not eat it up at once, and, of course, their droppings get in contact with the food and the place soon begins to smell. The runs and houses ought to be cleared out every day to keep everything clear and tidy, and I always advise those who say that they have not time, etc., not to venture too much, because if poultry cannot be looked after as they should be, it is not a bit of good trying to get any eggs. Another little important item which many neglect is fresh water every day, not forgetting earthen ware receptacles instead of dirty tins or cans, because earthen ware can be cleaned much better than anything I know. Grit is another very valuable article in the runs, there not being enough inside to be found, after the fowls have been there a little time. I always have a box of grit and shell handy at any time, and it is astonishing how much they enjoy it.—H. R. DAY in FEATHERED LIFE.

ENTOMOLOGY.

INSECT PESTS OF SOME LEGUMINOUS PLANTS.

In May a plant of *Crotalaria striata* was received for report. The plant for about a foot from the ground level was covered with a dense, white mass of the male scales of *Aulacaspis pentagona*, Targ. (*Coccidæ*). The female scales, which are of a greyish colour, are to be found buried among the male scales.

On the same occasion the stem of a bean plant heavily infested with the same insect was received.

This is a destructive insect in many parts of the world. It has a great variety of host plants, among them peach, and it is sometimes known as the West Indian Peach Scale.

In Ceylon it has previously been found on geranium, *Callicarpa lamata*, castor, *Tylophora asthmatica*, heliotrope, dadap (*Erythrina* sp.), *Allamanda*, *Flacourtia Ramontchi*. In other parts of the world it infests plum, pear, pecan, privet, grape, cotton, china-berry, *Capsicum*, papaw, mulberry.

In Jamaica Newstead found it in injurious numbers on *Castilloa elastica*.

Since Green wrote in 1896 (*Coccidæ of Ceylon*, Pt. II) this insect seems to have extended its range of food plants in Ceylon. Then geranium and *Callicarpa lanata* were the plants most severely attacked.

I have observed that the insect on *Flacourtia* is attacked by the Coccinellid, *Chilochorus circumdatus*, by a small, brown Coccinellid with Pseudococcus-like larva, by a small black chalcid, by the larvæ of a Cecidomyid, and by a minute, black Coccinellid probably of the genus *Cybocephalus*.

Another Coccid, *Hemichionaspis minor*, Mask. has been found recently on several occasions on species of Crotalaria growing by the roadside. One's attention is usually called to its presence by the white male scales. This too is an insect of wide occurrence and of varied diet. It is recorded from *Parsonia*, *Rhipogonum scandens*, *Hibiscus*, *Capsicum*, *Pelargonium*, cotton, pepper, coconut palm, *Melia azedarach*. Green records it (*Chionaspis albizziæ* Gr.) from Ceylon on *Albizzia stipulata*, and *Pithecolobium saman*, and I have taken it on *Hibiscus eriocarpus* and what may be a variety on *Cassia alata*. It seems a much less common insect in Ceylon than its near ally, *Hemichionaspis aspidistræ*, Sign. which is often very injurious to such palms as coconut, *Areca Chrysalidocarpus*. It is kept partly in check by coccinellids, chalcids and, Cecidomyids.

A much less conspicuous scale that I have also recently found on roadside plants of Crotalaria is *Lepidosaphes sp.* (prob. *gloveri* Pack), one of the so-called Mussel Scales. Mr. Green records this insect from the leaves and young stems of orange trees in Ceylon, and I have taken it or a nearly allied one on *Samadera indica*, variegated croton, and *Kurea santaloides*.

A species of membracid, *Leptocentrus sp.* (prob. substitutus) feeds on Crotalaria. These are sucking insects and may be recognised by the backwardly projecting thoracic spine and by their habit of sidling round the twig when disturbed. The eggs are deposited underneath the bark of the stem and of the leaf-stalks, and the regions where they have been deposited become corky and cracked. The eggs are subject to the attack of minute Hymenopterous parasites.

Another sucking insect, *Ragmus importunitas*, Dist. (*Capsidæ*) has recently been injuring Crotalaria at the Experiment Station, Peradeniya. It feeds on the leaves which become spotted with the black excrement. The insect is very small, about $\frac{1}{8}$ inch long, very active, bluish green in colour, with the legs whitish and provided with black spines. The apex of the rostrum or beak and of the tarsi is dark-brown. This insect occurs also in India on Crotalaria (Sann Hemp).

A dark green aphis is also occasionally to be found on Crotalaria.

The best application for use against the above mentioned sucking insects is Kerosene Emulsion. Aphides however are so much subject to the attacks of natural enemies, especially Syrphid larvæ, in Ceylon, that generally nothing requires to be done in their case. I have seen large colonies wiped out in a few days. In the case of *Aulacaspis pentagona* and *Hemichionaspis minor*, unless a large number of plants were attacked, it would be best to cut out and burn the infested plants. In other cases the stems should be rubbed with a coarse brush before the spray is applied.

A small dipterous maggot attacks the stems of *Crotalaria striata* var *acutifolia* at Peradeniya. It feeds in the pith, and a small hole with a purplish margin probably indicates where the maggot made its entrance. Puparia are to be found inside the stems. They are about 2·5 m.m. long, yellowish, darker at the ends and with two, short, sharp processes at one end. The adult fly is a small, black, shining insect with brown eyes. It is probably an *Agromyzid*, many of the species of which are injurious stem-or leaf-miners. It is probably not very injurious in Ceylon at present, but it should not be neglected. All badly attacked plants should be burned.

Crotalaria sp. is subject to defoliation by the carterpillar of *Argina sp.* (prob. *syringa*). The caterpillar has a habit of coiling itself up. It has a mottled appearance due to the presence of numerous black and white transverse bands. The head is reddish-brown, the thoracic legs black. There are four pairs of abdominal prolegs and one pair of anal prolegs ; the hooks are in a single row on the inner side of the proleg and become suddenly shorter towards the anterior and posterior ends of the row; there are about 15 of the larger hooks.

Each body-tubercle bears a long, black or white, shortly-feathered hair. The pupa is curved dorso-ventrally, shining, yellowish-brown on the dorsum, dark brown on the venter ; the dorsum of the abdomen bears large, black spots and on the wing-cases are black bands. The cremaster consists of 8 long hairs, each with numerous, hooked spines at the apex.

When not numerous the caterpillars should be collected. If numerous an application of lead arsenate or Paris Green should be made.

The seeds of *Crotalaria* are liable to be destroyed by a Tineid caterpillar which lives inside the pods. A small circular hole in the pod indicates where the moth has made its escape This hole is prepared beforehand by the larva. The caterpillar is small, of a dirty white colour, head brown, prothoracic and anal shield black, tubercles black. The pupa is abou 3·5 m.m. long brown in colour, darker at the ends. The apex of the abdomen is provided with a large number of long setæ hooked at the apex, some longer than others. The moth is a small, reddish-brown insect, palpi upturned and black at tip, eyes red, tibiæ and tarsi mottled brown and white. Usually an attacked pod contains a few good seeds.

TEPHROSIA CANDIDA.

Branches covered with mealy-bug, *Pseudococcus sp.* (*Coccidæ*) were received in April. So heavy was the infestation that the branches looked as if they were covered with snow. The correspondent remarks that it appears to kill the plant in time. The insect is covered with white powdery wax and possesses two long white, wax filaments at the caudal end, while slender glassy setæ or hairs are scattered all over the body. The insect is probably *Pseudococcus virgatus*, Ckll. which is a widely occurring insect and has been reported previously on Tephrosia as well as on cotton, *Albizzia moluccana* tomato, *Manihot*, *Acalypha*, *Castilloa elastica*, *Adiantum* and *Mimosa*. I have seen the same insect recently on young shoots springing up from a Cacao stump. Among the bugs sent in on Tephrosia was a pupa of *Spalgis epius*, whose caterpillar usually manages to keep this group of Coccids in check in Ceylon. Several Hymenopterous parasites emerged from the material. If a colony continues to thrive it would be well to cut off and burn the infested branches.

In May a branch of *Tephrosia candida* was received from Demodera infested with a species of *Cerococcus* (*Coccidæ*). The insects which are of a rusty-white colour were massed along the twigs. The waxy test can be easily peeled off exposing the shining, greyish-purple female. The body is hemispherical and the anal region, which is yellowish, projects beyond the margin. The test is hemispherical and about 3 m.m. by 2·5 m. m., excluding the free parts of the wax tufts. Of these wax tufts there are six rows, three on each side of the mid-dorsal line which is free of them. The lowest row is just dorsad of the line along which the test rests on the twig. Intermingled with such tests are several small, oval, dark yellow tests each with a shallow concavity on the dorsum at one end, while the remainder is covered with small tufts and isolated curled filaments.

This insect agrees closely with *Cerococcus hibisci*, Gr. described from *Hibiscus* (Bombay) and *Gossypium* (Pusa). There are twelve cribiform plates in groups of three pairs on each side in all the specimens examined. There are about six figure-of-eight pores in each anal lobe, which GREEN, who is usually very exact in his descriptions, does not refer to as occurring in *C. hibisci*. No parasite were observed. This insect is probably not common enough to cause much harm, but it should not be neglected.

On the same twigs nymphs and adults of a membracid, probably *Gargara mixta*, were feeding. The nymphs are green with the venter flat, dorsum convex, and are covered with short white hairs. The legs are yellowish-white. Ants are usually to be found in attendance on such insects.

A species of *Xyleborus*, prob. *fornicatus*, was received from Haputale in June with the report that the Tephrosia was growing in a field of tea affected with shot hole borer, and that the borer was causing the stem to break off just as in the case of tea. Some of the beetles were slightly smaller than typical *X. fornicatus*. In none of the samples of Tephrosia sent were larvæ or eggs found. The twigs were sent in lead-foil, and it is worthy of record that the beetles bored a clean cut hole through two thicknesses of this.

Leucæna glauca. A large colony of the Coccid, *Aspidiotus tataniæ*, Sign. was observed on the stem of a plant of this species growing as shade among *Coffea robusta*. The colony formed a conspicuous, scurfy, white patch. Each scale is roughly circular and of a greyish white colour. The insect is to be found underneath.

Desmodum cephalotes. A species of *Xyleborus* (prob. *X. fornicatus*) was recently observed to be attacking the stems of this plant. No eggs or larvæ were found in the tunnels.

Acacia decurrens. A disease that may be caused by an insect has been reported. The correspondent, who believes it to be caused by an insect, says, "The first symptom is small blobs of gum oozing out all over the bark just as if someone had been pricking the tree with a needle. After that the bark goes reddish-brown and cracks." The disease, he adds, has spread all over the clearings. Streams of gum occur all over the stems, and the bark is so impregnated with gum that it is as hard as iron ; ultimately it cracks both longitudinally and horizontally. When one examines a recently diseased area in bark that is still soft he sometimes finds, on cutting away the bark in thin slices, a small discoloured area with five or six dark spots in the centre. In one case by carefully scraping away the gum I found what were without doubt six eggs located over the dark specks. They were flat and overlapped somewhat like the tiles on a roof ; the outline of the group was triangular. Sometimes, however, gum oozes from a wound that shows no such dark specks. Followed deeper into the bark the dark specks disappear and the wounded tissue becomes more diffuse, very often breaking up into channels of gum that run horizontally and vertically in the bark and often merge into minute, dark-coloured streaks.

This disease has been spoken of as "Fire Blight" but it is quite distinct from the "Fire Blight" of Acacia of Australia ; the latter disease is due to the attack of a beetle, *Paropsis orphana*, Erich., on the leaves. The leaves turn brown giving a plantation the appearance of a fire having been through it; the effect is to make the bark difficult to strip and at the same time to render it poor in tannic acid.

The caterpillars of the moth *Euproctis scintillans*, Wlk. and of a species of Tortrix have been reported as doing damage to *Acacia decurrens*. The Tortrix had also attacked the tea, and the correspondent makes the observation that the pest was confined to two Acacia-planted fields, situated at opposite ends of the estate.

The caterpillar of *Euproctis scintillans*, Wlk. is greenish-brown in colour, with a light brown head and bears long white hairs on the tubercles. There is a pair of prominent tubercles, that on the first being bounded laterally by a short yellow band with an orange spot near its middle. From the second to

the seventh (inclusive) abdominal segments extends an orange-red, dorsal stripe bounded laterally on each side by a yellow band. The dorsum of the eighth abdominal segment bears a prominent tubercle. The third thoracic segment has a slight orange tinge on the dorsum.

The pupa is greyish-brown, except the dorsum of the abdomen which is reddish-brown, and the wing cases and apex of the abdomen which are yellowish. The body bears long white hairs. The cremaster consists of many hooks. The pupa is enclosed in a thin dirty-white cocoon, in a state of nature probably enclosed in a casing of earth. The moth has the forewing brownish, with small scattered black scales and three yellow areas along the distal margin of the wing. The hind wings are light yellow and the apex of the abdomen bears a tuft of orange-coloured hairs.

I have taken the same caterpillar eating a hole in the side of an unopened cacao flower.

A. RUTHERFORD.

CEYLON AGRICULTURAL SOCIETY'S STAFF.

The Organising Vice-President proceeded to England on the 5th May last to represent Ceylon at the recent Rubber and Allied Products Exhibition in London, since when Mr. T. Petch has been acting.

The Secretary completed his annual circuit through the various provinces, inspecting the work of the Instructors and visiting the Gardens worked under the auspices of the Society. He was absent in India from the 6th to the 15th December last, attending the All-India Agricultural Conference held at Coimbatore from the 8th to the 13th idem, and on his return submitted a report which was presented to the Board of Agriculture at a meeting held on 3rd of February last.

The Society is the poorer by the death of Mr. N. M. Jayasuriya, Agricultural Instructor, stationed in the Hambantota District. Mr. Jayasuriya showed great aptitude for his work, and the persistency and thoroughness he displayed in all he undertook made him a valuable officer whom it is difficult to replace. Mr. A. A. Jayasinghe is at present under training at the Experiment Station, Peradeniya, with a view to his filling the vacancy that has been created on the staff.—C. A. S. Report.

TEA AT THE GOVERNMENT EXPERIMENT STATION.

The yield for the months of June and July was 10,559 lb. of green leaf and the price $6\frac{3}{4}$ cents up to August 8th, when it was reduced to 5 cents owing to the war in Europe.

In plots 151-154, interplanted with Hevea, the lower branches of the trees have been lopped.

The vacancies in plots 146-150, supplied in June, are beginning to shoot from the stumps. These have been lightly mulched against the dry weather of September.

Holes 1 × $1\frac{1}{2}$ feet have been dug in plots 141-145 and 151 ready for supplying up in October. The holes have been dug rather larger than usual, so that weeds can be thrown in during the next six weeks and allowed to rot.

All drains have been thoroughly cleaned and deepened.—Progress Report, Peradeniya Experiment Station.

CO-OPERATIVE CREDIT MOVEMENT.

CO-OPERATIVE CREDIT IN CEYLON.

This movement is now fairly launched and the first year's work was commemorated by a conference held at the King's Pavilion, Kandy, under the presidency of His Excellency the Governor. As a meeting of those actively interested in co-operation, the conference was a success; and His Excellency's presence was of great encouragement indicating as it did his recognition of the significance of the occasion as a stage in the progress of a far-reaching movement fraught with immense possibilities to the people of this Island.

Mr. N. Wickremaratne, the Secretary to the Board of Control, gives the following summary of the work so far accomplished:—

39 Societies have been registered, and other applications for registration have been received and are under consideration by the Registrar. Mr. J. A. Wirasingha, Mudaliyar of Rayigam Korale, has succeeded in establishing four Societies in his korale. The public men of Jaffna have established a Central Society in the town with a view to finance the smaller societies of the district. The Assistant Government Agent, Matale, has appointed a Central Committee whose business it will be to visit villages round about Matale, explain the object of Co-operative Credit and help to establish Societies. —C. A. S. Report.

HOW CO-OPERATION CREATES CREDIT.

The most hopeful of all the movements in the life of India to-day is co-operative credit, and in the important Resolution recently passed by the Government of India its direct benefits and its incalculable potentialities are fully recognised. Ten years ago co-operation in any form was practically unknown in India, but to-day, as the Resolution points out, "there are over twelve thousand societies with nearly six hundred thousand members and with a working capital of over five crores of rupees." Such a growth as this can only be described as stupendous; it puts in the shade the mango trick of the Indian conjurer. There is indeed some difficulty in realising that so great an economic miracle has actually come to pass. Individually, the 600,000 members of the co-operative credit societies have no credit worth speaking of. How small it is can be seen from the fact that a money lender will ordinarily only lend money to a ryot at 33 per cent., and will advance only small sums even at this high rate of interest. Yet when the credit of these borrowers is combined in co-operative societies, they are trusted with five crores of rupees on their personal security and the rate of interest sinks to twelve or even six per cent. Obtaining capital on these terms, the cultivator can pay off his debts,

receive the full return on his labour, and enjoy an ever-inreasing prosperity. If we allow five dependents to each co-operator, some three millions of people have been raised from hopeless bondage to a cheerful independence. The calculation of the Government of India is that the cultivators have been delivered from the absolutely unnecessary payment of twenty lakhs a year—a very substantial sum to add to the income of the toilers of the fields. Even this large saving is only a part of the pecuniary benefit conferred by co-operation, for, as every one who has watched the working of the societies is aware, their indirect effect has been to reduce the rate of interest all round. The Government of India are thus amply justified in their claim that in all about six million persons in this country are gainers by the beneficent agency which the world owes to the philanthropy and genius of Raiffeisen. But co-operative credit, as it was conceived by its discoverer, and as it has revealed itself in practice, is much more than an agency for getting people out of debt. To the individual it teaches thrift, enterprise and foresight. In the community it brings to the front the men whom the village trusts and it develops into a powerful force that instinct for combination and mutual help which is never altogether absent from an Indian village but which may have become very feeble by disuse. This social aspect of co-operative credit invests the movement with great importance. The revival of corporate village life has long been the aim of the Government of India, but all artificial creations for this purpose have failed. Co-operative credit, however, has in many places developed on such lines to suggest that the societies may become real village panchayats. Self-help and co-operation in financial matters have been extended to the correction of social abuses, the promotion of education and sanitation, and the improvement of the community as a whole. It has been repeatedly urged in these columns for many years that societies which thus showed the desire and ability of the people to help themselves were precisely the organisation which would fill the place of the old panchayats. A few months ago the Hon. MR. LYON, in a striking speech, predicted the political utility which the societies might attain, and now we have a confirmation of this view by the Government of India who not only suggest the theoretical possibility of this revival of corporate village life but who enjoin on the District Officer the duty of keeping in touch with the societies and of giving them such assistance as he can render without interfering in their internal affairs. Care must, of course, be taken not to graft too many new activities on the thriving young stock, but there can be little doubt that in co-operative credit we have a real, living movement—a stirring of the dry bones of a vanished communal life !—INDIAN AGRICULTURIST.

GENERAL.

THE AUTHOR OF THE "BIRDS OF CEYLON."

Colonel (better known as Captain) William Vincent Legge, F.Z.S., F.R.G.S., the author of the monumental work on the Birds of Ceylon and numerous ornithological papers, served in the Island for 9 years (1868-77). Though he rendered valuable military service to the Empire he will probably be best remembered for his literary and scientific work. Since his retirement and residence in Tasmania he has occupied the position of President of the Australian Ornithological Union and of the Biological section of the Association for the advancement of Science as well as Chairman of the Council of Agriculture, Tasmania.

Colonel Legge writing to the Secretary of the Ceylon Agricultural Society in July last says:—"I may possibly visit Ceylon next year . . . . I should much like to see the dear old Isle again." This will be pleasant news to many old residents, and we have no doubt that our National History Society will extend a hearty welcome to our visitor.

C. D.

THE RINGING OF TREES.

The following extract from an article by Mr. L. A. Boodle in the Kew Bulletin No. 6 of 1914 should prove of interest to tropical planters:—

The effect of ringing differs in different kind of trees. Various experiments have been made, and a study of the results of the operation proved useful in the early days of plant physiology in leading to a knowledge of the route of conduction of water and of elaborated food-substances in plants. Experiments in ringing were made by Malpighi and Ray, of whom the latter mentions that a holly tree lived for several years after a ring of bark of a hand's breadth had been removed from the stem so as to leave the wood bare. Since this early observation numerous experiments have been made on several kinds of trees, and form two classes, viz:—(1) bark-ringing, i.e., the stripping off of a ring of bark as in the case mentioned above; and (2) wood-ringing, i.e., making an annular cut into the stem through both bark and part of the wood.

Bark-ringing.—The effects of bark-ringing depend upon the interruption of the bark and the exposure of the wood. The break in the continuity of the bark prevents the normal conduction of elaborated food-substances (albuminous and carbohydrate) from the parts above the ring-gap to those below, since these bodies are ordinarily conveyed through the bark (or more precisely the phlœm). Hence, if there are no leaf-bearing branches on the stem below the point of ringing, starvation of the roots ensues. This may be slow, seeing that there is a store of food in the bark of the roots and of the base of the trunk to draw upon, but the growth and absorptive powers of the roots will eventually be checked, and in some cases the functional failure of the roots may be the final cause of the death of the tree.

COL. W. V. LEGGE, F.Z.S., F.R.G.S., &C.
AUTHOR OF THE "BIRDS OF CEYLON."

The exposure of the wood, where the bark has been removed, introduces other factors endangering the life of the tree. The supply of water for the upper part of the tree has all to pass through the wood at the level of the ring-gap, and from several causes the conducting power of this wood tends to become more and more curtailed until the requisite amount of water can no longer pass through it. Owing to the surface of the wood being in contact with the air, the outer layers of wood become dry and useless for conduction. This alone may soon render the water-supply insufficient in species with only a thin zone of sapwood, since true heart-wood is incapable of conducting the transpiration stream. On the other hand "sapwood trees" (i.e., those which form little or no heart-wood) can usually survive the operation of ringing for a long time, e.g. several years. Among these the progressive drying of the wood from without inwards may finally restrict the area of functional wood until it reaches the critical point, or this result may be accelerated by a fungal disease attacking the wood and rendering some of it useless. Again, in trees which form heart-wood, the production of this accounts for the loss of a certain proportion of the wood available for conduction. While no new wood is added at the level of ringing, and functional wood is lost externally by drying, there is a further loss internally owing to the yearly conversion of some sap-wood into heart-wood.

To summarise, bark-ringing eventually causes the death of the upper part of the tree, because the water supply becomes inadequate, either through loss of conductivity in the wood at the level of the wound, or through deficiency of absorption by the roots.

An interesting example of bark-ringing may be quoted here. A forked pine-tree was chosen by Hartig for an experiment. The tree was 118 years old, and the trunk was forked at 4½ m. above the soil into two approximately equal stems. The bark was peeled off all round one of these stems at about 3 m. above the point of forking. When the tree was felled 18 years after this ringing operation had been performed, it was seen that the crowns of both stems were still sound, but that the foliage of the ringed stem was thinner and weaker than that of the other stem. It was also found that growth in thickness had practically ceased after ringing on the side of the trunk situated below the ringed branch. The reason for the long-continued life of the ringed stem is that the roots attached to the base of the trunk on the side below the intact stem had received normal nourishment, and therefore, having remained healthy, had been able to supply the trunk with a good supply of water.

Wood-ringing.—The experiments in wood-ringing made by Strasburger and others show that, though the inner (older) layers of sap-wood can conduct water for the transpiration current, the heart-wood cannot do so. The first of the following cases serves as an example of a sap-wood tree, the remainder being "heart-wood trees" (i.e., trees which form heart-wood).

Two beech-trees 150 years old had trunks 32 cm. in diameter. These were ring-cut to a depth of 8 cm., and the trees still bore foliage a year and a half later.

The trunk of an oak 50 years old was ring-cut into the heart-wood, and its foliage withered in a few days. Another oak of the same age, which was cut similarly but not quite through the sap-wood, did not wither for some weeks.

The trunk having been cut to the heart-wood in a tree of *Prunus avium*, and in a *Robinia*, wilting of the leaves took place in two days in the first case, and in a few hours in the second.

Various other experiments and observations have been made in bark and wood-ringing, but enough has been quoted to illustrate the nature of the results obtained in this way.

C. D.

SUNNHEMP (CROTALARIA JUNCEA).

The Sanskrit name *Sanam* occurs in ancient works like Manu's Code in which sunnhemp fibre is said to be appropriate for making the sacred thread for the Kshatriyas just as cotton is appropriate to the Brahmins and wool to the Vaisyas. The Sanskrit name is apparently the root of all vernacular names of the plant, except one, used in the Presidency, of the Latin name Cannabis applied to a different fibre plant (Ganga) and the English name hemp. The expression sunnhemp is tautological, "hemp" being a transformation of "Sanam." "Sanam" changed into Sanap (m and p being both labials), Sanap assumed the form "hanf" and eventually "hemp." The plant is called *Sanappu* in all the Tamil districts except Tinnevelly, where the name is corrupted into *Sadambu*. The Tulu name *tashambu* appears to be a similar corruption of the Sanskrit name. The plant is called Zanumu in Telugu and Senabu in Canarese. The Uriya name *soni* is but a slight corruption of the Sanskrit *Sanam*. Strange to say, the Malayan name *Wuckoo* alone has no connection with the Sanskrit name. *Wuckoo* literally means "border" being cognate with the Tamil *packam* and particularly applied to the sunnhemp grown on the borders of Travancore, and is elsewhere in the Malayalam country applied to the Dekkani (*Hibiscus cannabinus*) as well as the sunnhemp indiscriminately. The first part of the botanical name means rattle, as the ripe pods with the seeds lying loosely in them, make a grating noise, when shaken. *Juncea* refers to the "rush-like" stalks of the plant. Strange to say, the Telugu word "Zanuma" has now become generic in the Telugu tracts of Ganjàm aud Vizagapatam, sunnhemp proper being called there Katta Zanumu (katta meaning stick) and the Dekkani hemp "Gogu Zanumu."

ADVANTAGES OF SUNNHEMP IN A ROTATION.

The crop is fit for harvest in three months after sowing and does well on poor or sandy soil. Its cultivation is inexpensive, for it needs neither interculture nor manure. The bast separates easily when retting is thorough. By the agency of the bacteria dwelling in its root tubercles, it assimilates the nitrogen of the soil air and fertilizes the soil with that precious plant food as well as with its sheddings.

SOIL.

Loamy soil of mixed black and red colour is the best, loamy black soil comes next, and then loamy red soil. The crop grows fairly well even on the sandy soils of the coast. On sandy soils the crop grows tall and has comparatively long roots. Throughout the Presidency, poor soils are as a rule selected. The crop is believed in the Gôdàveri district to be predisposed to disease if cultivated on a fertile soi . Above all, the crop needs a high and well-drained situation. In the Gódáveri, Kistna, Guntúr, and Tinnevelly districts, the bulk of the crop is cultivated on wet land. Elsewhere the crop is as a rule irrigated whether cultivated on wet or other land. In the Ganjám and Vizagapatam districts, the crop is cultivated on unirrigated land and so also the crop sown to a trifling extent mixed with other crops in the Deccan districts and the upland taluks of the Guntúr district.

ROTATION.

On wet land, sunnhemp alternates with paddy in the Tinnevelly district; sometimes it follows turmeric. In the Gódáveri district, it is cultivated as the first crop and is followed by tobacco, horsegram, Bengal gram, Jonna and paira gingelly. In the Erode taluk, sunnhemp comes after the cereal crop of arisi—cumbu and adar cholam (fodder crop). As a rule sunnhemp is not cultivated on the same land in the Tinnevelly district except at intervals of three days.

SOWING.

The seed rate is the heaviest in Tinnevelly where it is the same as for paddy, viz., 1 kottai or 112 Madras measures of seed for 1 kottai of land, viz., 1·68 acres, that is nearly 70 Madras measures per acre. In the Bhaváni taluk, Coimbatore, for instance in Dalavaipalayam, the seed rate is 14 vallams or about 33 Madras measures per acre. In the Gódáveri and Kistna deltas 20 to 30 seers (80 tolas rice contents) or about 14 to 20 Madras measures and in the Ganjám and Vizagapatam districts, about 60 seers or 40 Madras measures of seed are sown. On dry lands in the upland taluks of the Guntúr district and in the Kurnool and Ceded districts, about 1 or 2 giddas (1 gidda ¼ pint) of seed are sown mixed with 1 manedu (4¼ pints) of Jonna and various other seeds. The seed rate for the summer crop is much smaller than for the rainy weather crop.

In the Tinnevelly district the method of sowing and covering the seed is very peculiar. After the soil has been ploughed and watered as said before, it is sown broadcast and then while water is standing on the land levelled by a plank of palmyra or coconut wood drawn by two men, each holding a rope fastened near one end of the plank. On land that has been dug in the process of harvesting turmeric in the Tinnevelly district, the land is ploughed once if it has settled and levelled by the plank drawn by a pair of bullocks, without being irrigated at all. In other parts of the country, the seed is sown on ploughed land and covered by land being ploughed once or twice or by being brush-harrowed. In the Ganjám and Vizagapatam districts, seed is covered by working the ladder harrow called *Moi*, in Uriya. In Tinnevelly, if seed is sown on well-ploughed land, the levelling plank is dispensed with. In Tinnevelly the crop is so densely sown that the plants are only 2½ inches to 3 inches apart both ways, and an acre carries about 7 lacs of plants. It has been observed that the sunnhemp stalks on a sandy soil are as tall and thin as those of a crop sown twice as densely on a more fertile loamy soil in Tinnevelly. The denser and thinner the stalks are over a given area, the greater of course is the quantity of bast issue.

The object of sowing the crop so densely as stated above is chiefly to induce the plants to grow erect without branching. At the points where the stalk branches off, there would be breach of continuity of fibre which would thereby be short.

In the upland taluks of the Guntúr district, chiefly Vinukonda taluk sunnhemp seed is drilled in 9 to 12 rows by the ryots amidst a Jonna (*Andropogon sorghum*) or Sajja (*Pennisetum typhoideum*). The seed rate in such cases is two manikalu (294 cubic inches or nearly 3 Madras measures) per acre. This is the only instance of sunnhemp seed being drilled. Two hundred plants thus grown make a bundle of the same size as 30 plants growing sparsely.

WATERING.

The crop is watered after the land is ploughed and before seed is sown in the Tinnevelly district, and after the levelling board has been worked, the water is drained off. The crop is irrigated ten days afterwards. Thenceforward the irrigation is at intervals of about a fortnight in the absence of rain and if the weather be cool, watering once a month would suffice.

HARVESTING.

The irrigated crop is generally harvested in three months after sowing. Sometimes the flowers drop off and then the crop is kept till it flowers again and seeds. It then becomes a four months' crop. The unirrigated crop very sparsely mixed with Jonna and other crops on dry land in the Deccan districts and the upland taluks of the Guntúr district is harvested five months after sowing.

It is very strange that statements made by such great authors as DR. ROYLE and COL. DRURY regarding the general method of harvesting sunnhemp should be found to be untrue. DR. ROYLE says "The Telugu people consider the fibre to be in the greatest perfection when in flower, when it is pulled up by the root."

DRURY says: "The mode of preparation differs from that of other fibres in one particular especially, the plant being pulled up by the root and not cut." These statements are quite true in regard to "Gogu" or Dekkani hemp (*Hibiscus cannabinus*), but not at all in regard to sunnhemp. Nowhere in the Gódàveri and Kistna deltas is sunnhemp pulled by the root. In the Ganjám and Vizagapatam districts, the crop on soils of loose texture is, indeed, pulled up by the root, but the butt ends are afterwards cut. It is only in some parts on the sandy soils of the West Coast that the crop is pulled by the root and retted therewith.

STACKING.

After the stalks are dried and the seed threshed out, the bundles are stacked like those of cholam straw in the shape of a gabled roof in all parts of the Presidency except the Ganjâm, Vizagapatam, Gódáveri and Kistna districts, where the stalks are steeped in water immediately after harvest. In these places the bundles are so piled that their butts and the tapering ends in any two consecutive courses of the stack are alternately outwards and inwards, so that the surface of the pile may be even. The gable of the stack consists of the bundles laid longitudinally and the whole is covered with stalks from which fibre has been already extracted. The roofing bundles are made to project as to form eaves. Care is taken that the bundles are not wetted by rain. A number of bundles are removed from one end of the stack from time to time when required for fibre extraction in such a manner that the remaining bundles at that end may not be exposed to rain. The bundles in the whole stack are removed in the course of a year and fibre manufactured therefrom.

RETTING.

The sunnhemp stalks are kept in the stack for at least a fortnight, lest the fibre should be weak and not for more than a year. A Shanappan provides himself with a sufficient supply of stalks to give himself and other members of his family including the females sufficient work throughout the year in the way of extracting the fibre and weaving fabrics; and the *Perikivandlu*, of the Northern Circas, similarly provide themselves with a sufficient supply of fibre. There is a very large demand for sunnhemp bags for exporting the hill produce of Palkonda to Párvatipuram. It is the business of many families of Perikivandlu who reside in Kandisa, Neelavalasa, Tambadapalli, Tunivada, etc., to meet demand for sunnhemp bags.

As said before, the stalks of sunnhemp are steeped in water in the Northern Circas immediately after the harvesting of the crop. In other parts of the country small quantities of stalks are retted, as required, from time to time throughout the year. The sunnhemp bundles are untied and spread like a mat being fastened with palmyra fibre, about 9 inches thick. Across the stalks at both ends of the layer, stalks are laid and bound to the plants below by palmyra fibre. Turf is then placed over the whole and over the turf sandy earth is put so as to keep the stalks well down in water.

In the Tinnevelly district, tanks fed from the Tambraparni channels are used for retting purposes. The superiority of the Tinnevelly fibre is probably due to the superiority of the water in which the stalks are retted. The water is good as compared with the quality of the water generally available elsewhere. In the Coimbatore district and other parts of the country pools of stagnant rain water are used for steeping purposes. The Gundlakama

A field of sunn hemp (Crotalaria juncea) at Uduwawela (Kandy district) grown by MR. W. MOLEGODE, Agricultural Instructor, between two paddy crops.

Sown July 24, 1914. Reaped September 17, 1914.

water is highly esteemed for retting sunnhemp stalks. The stalks should not be retted under the shade of overhanging branches of trees but should be well exposed to sun. If the weather be still and hot, the retting is complete in four days. This is the case generally with the summer crop. The older the crop is, the longer does it need to be steeped. The thicker portions of the stalks need to be steeped longer than the thinner portions, so that if the thicker portions are steeped long enough, the thinner portions are apt to be injured by over-steeping. It is chiefly in Hingallyghattu, Aska and other villages in the Ganjám district that the very rational practice of stooking the plants on their butt ends so that only about the lower third of their length may be immersed in water for about two or three days and laying the plants horizontally afterwards so that the plants may be completely immersed in water prevails. This practice is worth adoption in other parts of the country. DR. ROSEBURGH found by experiments that with warm water at a temperature of 80 degrees F., the outturn could be increased by 20 per cent. Since the Shanappars ret very small quantities of sunnhemp stalks at a time, which do not occupy more than 16 or 20 square feet of space, it is worth while to determine by experiment whether the retting of the stalks may not be very much expedited at moderate cost by covering the top of the reservoir with panelled glass which would retain the heat below. The stalks of the crop harvested in September or October and the stalks of the crop grown on dry land and harvested in December or early in January take eight days or more to be sufficiently retted.

If fibre separates easily when the stalks are rubbed across with the fingers, it is concluded that the stalks have sufficiently retted.

In the Gódáveri district, the fishermen called *Pallivendlu* extract fibre of superior quality by steeping the stalks one day longer than the Perikivandlu would do and beat the bundles of stalks on water as is done in Tinnevelly and Coimbatore. Very coarse fibre called *mutakanara* is extracted from insufficiently retted stalks. The fibre is mixed with a very large proportion of pieces of sunnhemp sticks. Three sorts of fibre are met with in the Gódáveri district, viz., *Mutaka*, *periki*, and *palli*, the last being the best and quite free from sticks. In the Kistna and Gódáveri deltas except in the case of *pallinara* the retted sunnhemp stalks are not beaten on water. In the Tamil and the Gànjàm and Vizagapatam districts, when the stalks are found to be sufficiently retted, each bundle is held in both hands at first and is beaten on the water surface at the other end, generally six times, the bundle being twirled about so that every part may be beaten. The beaten end is then held in both hands and the other end is now beaten on water as said before. The bundles of plants thus beaten are stooked against each other in regular rows in order that the water may drain off and the plants may dry a little but not much. Each stalk is then taken in hand, an inch or two of the apical portion of the pith is broken and the mass of fibre in that portion being held firmly in one hand, the pith is removed with the other hand.

In the Gôdáveri and Kistna deltas, as soon as the stalks are found to be sufficiently retted, a whole bundle is broken near one end and the fragments of the pith or boon or shore as it is technically called on that side are removed by one sweep of hand, the man applies his right knee against the fractured ends of the stalk and by drawing towards himself the mass of fibre of the pieces already thrown away, the remaining long fragments of the boon are expeditiously detached. One man can thus remove in half a day the boons from 1,000 small bundles 1 foot in girth. One manika ($4\frac{1}{4}$ pints) of grain is paid for reaping plants which would make 100 small bundles and the same is the rate of wages for removing the boons from 100 bundles. In some villages near Aska, the boon is detached in a very interesting and skilful manner. By manipulation with the fingers the fibrous tissue is first

separated from both ends of the stalks in a handful, one man then firmly holds the fibrous tissue alone either at the butt or apical end and another man, holding the ends of the boons, exerts a strong pull whereby the boons are detached. The fibrous tissue is then squeezed between the palms of the hand or on a stone so as to separate the fibres which are then hung up to dry. When the fibre has fairly dried it is twisted and trodden upon in Tinnevelly and Coimbatore by women so as to free it of small stones, bits of sticks, etc. The women hold a pial for support while treading on the fibre. The twists are then hung up and struck with a flat bar of wood so as to free it further from dust, sticks, etc. The twists are then folded so as to exclude air as much as possible and kept till required for manufacture of some sort.

To ret five cart-loads of 50 large bundles of sunnhemp which represent the produce of 1·68 acres, 50 women and 50 men are required.

OUTTURN.

In the Tinnevelly district, a fair outturn of the crop is represented by five cart-loads or 50 bundles of stalks which would produce about 70 tulams or 1,400 lb, of fibre from one kottai or 1·68 acres of land, which is equivalent to about 845 lb. of fibre per acre. One tulam of fibre sells for one rupee. Therefore 845 or about 42 tulams are worth Rs. 42. The rainy weather crop yields a larger outturn of fibre than the summer crop which yield only about four cart-loads of stalks.

In Dalavaipalayam 40 head-loads consisting of 4,000 handfuls of stalks are obtained from an acre. The value of this at 8 annas per head-load is Rs. 20. In the Vinukonda and other places where sunnhemp is grown on unirrigated land, sparsley mixed with Jonna and other crops, only about one maund of sunnhemp fibre is produced per acre, two maunds being obtained per acre from sunnhemp which is drilled. In the Gódâveri and Kistna deltas the outturn of the fibre per acre is 20 to 30 maunds of 25 lb. each. In the Tanuku taluk 100 bushels of stalks six feet in girth are obtained per acre. The outturn of pallinara is not more than about 500 lb. per acre. The outturn in the Ganjâm and Vizagapatam districts, where the crop is unirrigated, is 100 visses or about 350 lb. of fibre per acre.

The outturn of seed per acre is as follows :—

Tinnevelly	250 Madras measures.
Coimbatore	2 modas or 192 Coimbatore pucka measures = about 230 Madras measures.
Kurnool and upland taluks of the Guntúr district	20 manikas or about 28 Madras measures.
Ganàjm or Vizagapatam ...	20 nowthies, or 240 seers = 160 Madras measures.

The price of one tulam or 800 tolas or 20 lb. of fibre is 1 or $1\frac{1}{4}$ rupee or the price per candy is about Rs. 31. In the Gódàveri and Kistna deltas, the price is Rs. 30 to Rs. 50 per candy.

The price of seed in Tinnevelly is Rs. 12 to 15 per kottai of 112 Madras measures, that is, about $7\frac{1}{2}$ measures per rupee.

In Coimbatore, the price is eight vallams per rupee, that is, about 1 an a per Madras measure. In the Gôdáveri district the price is 3 kunchams or 12 seers or about 8 Madras measures per rupee, that is, 2 annas per measure.—C. K. SUBBA RAO IN BULLETIN NO. 59 MADRAS DEPARTMENT OF AGRICULTURE.

FISH OILS AND GUANO FROM INDIA.

The preparation of sardine oil and guano forms an important part of the experimental work of the Madras Government Fishery Department. Hitherto such work has been carried on at the Cannanore Experimental Station, but

during 1911-12 it was transferred to the Experimental Station at Tanur, where fish are usually more abundant. At first crude oil only was prepared, but as there is a better market for the finer grades of fish oil, new machinery has been installed at Tanur for producing pale-coloured oil, for separating the "stearin," and for refining the oil, whilst deodorising experiments are also to be conducted there. The efforts of the Department to create a local fish-oil industry have been highly successful; in 1909 there was only one private factory, whilst at the beginning of the 1911-12 season between forty and fifty small factories were producing crude brown oil in Malabar and South Canara, and it seems probable that factories will also be started in Cochin and Travancore.

As the supply of fish along the coast fluctuates considerably, and the amount of oil in the fish varies in different seasons, it is suggested that a large number of small factories is preferable to a small number of central factories. Attempts have also been made to devise methods suitable for use by single native families, in order to establish a kind of cottage industry.

In the small factories where crude brown oil is being produced the methods followed are of a simple kind. The fish are boiled in open pans, holding one-half or two-thirds of a ton, and the resulting mass is placed in coarse coir bags and pressed in simple screw presses. The pressed cakes of guano are broken up and placed on mats in the sun to dry. The crude oil is stated to fetch Rs. 160 (approximately £10. 10*s.*) per ton of about 250 gallons at the factory, the middleman supplying the casks and bearing the cost of transport; the guano realises about Rs. 70 (approximately £4. 10*s.*) per ton.

Several samples of the sardine oil and guano made in Madras have been received recently at the Imperial Institute from the Madras Government Fishery Department, and as the results of their examination are of general interest, they are now published.

FISH GUANO.

The following samples of fish guano were received along with samples Nos. 9 and 10 above:

No. 1. "Fish guano prepared at the Government Fisheries Stations, South Malabar."

No. 2. "Fish guano prepared at the Government Experimental Station at Tanur, South Malabar;" (a) "Ordinary guano," (b) "Guano from large oily sardine."

The guanos consisted of fragments of the bones, flesh, and scales of small fish. They were examined with the following results:

TABLE I.

	No. 1.	No. 2a.	No. 2b.
	Per cent.	Per cent.	Per cent.
Moisture	7·86	8·82	8·68
Crude proteins	49·22	53·65	56·40
Consisting of True proteins	43·75	45·41	49·06
Other nitrogenous substances	5·47	8·24	7·34
Fat	6·69	5·38	8·52
Other organic matter ...	7·37	4·73	5·01
Ash	28·86	27·42	21·39
The ash contained:			
Lime CaO	33·10	42·32	42·12
Potash K2O	0·85	2·17	2·19
Phosphoric anhydride P2O5	29·52	35·32	35·56

The following table shows the percentages of lime, nitrogen, phosphoric anhydride, fat and water present in these three samples of fish guano from South Malabar, compared with the corresponding figures recorded for fish manure from other sources:

TABLE II.

	Lime CaO.	Nitrogen N.	Phosphoric anhydride. P_2O_5	Fat.	Water.
No. 1 ...	9·6	7·8	8·5	6·69	7·86
No. 2a ...	11·6	8·6	9·7	5·38	8·82
No. 2b ...	9·0	9·0	7·6	8·52	8·68
Fish manure from refuse (United Kingdom)	—	7·8	8·1	—	18·9
Dried menhaden scrap (U.S.A.)	—	8·0	8·5	—	Not exceeding 12·0
Norwegian cod heads and bones.	—	8·0	14·9	—	13·0
Norwegian whale manure	16·5	7·6	13·4	—	5·3
Dried codfish skins & bones	—	8 to 9	10 to 12	—	5 to 6
Canadian dogfish scrap	—	8·8	7·7	16·6	5·5
Brittany fish manure	—	6·5	13·1	—	5·0

The commercial fish meal sold in Europe as food for cattle and pigs contains the following proportions of the most important constituents :—

TABLE III.

	Proteins.	Phosphoric anhydride.	Fat.
	Per cent.	Per cent.	Per cent.
English meal from fish refuse ...	50 to 65	6·6 to 8·5	3 to 6
Norwegian codling meal ...	50 to 60	11·3 to 13·1	1 to 2
Herring meal ...	60 to 70	3·7 to 4·7	10 to 12

A comparison of the figures given in the table above for well-known commercial fish manures with those recorded for the present samples of fish guano from South Malabar shows that the latter contain about the same percentage of nitrogen as the other manures and an average amount of phosphoric anhydride, and there is therefore no doubt that they would be readily saleable as fish manures.

These Indian fish guanos are not quite so rich in proteins as the fish meals mentioned in Table II. They contain, however, average quantities of phosphoric anhydride and fat, and would no doubt be readily saleable for the preparation of feeding-stuffs of the fish-meal type, provided they are prepared from fresh fish and are kept in good condition.—IMPERIAL INSTITUTE BULLETIN.

COMMON SALT AS A POISON FOR STOCK.

F. B. GUTHRIE.

Although a certain amount of salt is a necessary adjunct to the food both of human beings and of animals, certain kinds of animals are susceptible to it when supplied in excessive quantities.

In the case of pigs and sheep, 4 to 8 ounces is said to have produced poisoning. In larger quantities it has proved fatal to horses, and even to cattle. Fowls would appear to be particularly susceptible. Suffran (see Lander) has conducted experiments with fowls, and finds that 4 grammes per kilo body-weight (about 80 grains for each pound body-weight) are fatal if injected in solution into the crop. Several instances have recently been brought under the notice of the Department in which the deaths of poultry and pigs have been traced to an excessive amount of salt in the food. Quite recently the body of a fowl which had died suddenly was forwarded to the Department. On examination the organs were found to be healthy, and little abnormality was noticed except that the veins in the neighbourhood of the throat were suffused, and there was a slimy exudation in the mouth, resembling the appearance seen in croup. The crop was distended and the contents, which weighed 50 grammes, were apparently of the usual nature, consisting of grains of wheat, straw, plant-residues, and pollard or bread.

On examination it was found that the 50 grammes of crop contents contained 2·42 grammes of common salt, or 4·84 per cent.

About a year ago several cases of sudden deaths among poultry were reported, which were traced to their having been given pollard which was highly inpregnated with salt.

Several samples of pollard were sent for examination, which contained excessive and varying amounts of salt. One sample contained no less than 32·2 per cent. by weight of common salt. In this case salt crystals were easily noticeable, and could be picked out by hand or separated by blowing away the pollard.

Other samples contained varying amounts, down to 5·8 per cent. salt. In all these cases fatal effects had resulted, for which no other cause could be given except the presence of excessive amount of salt.

In another instance a case of poisoning of pigs was reported which remained unexplained until the food supplied was examined. The food complained of was a mixture of pollard and barley-meal. A tin of the mixture showed 11·66 per cent, common salt. On separating the pollard from the barley-meal, the former was found to contain 18·3 per cent. salt.

The source of this pollard was never satisfactorily explained. Whether by accident or intentionally, there appears to have been at the time a considerable amount of this salted pollard on the market. It appears to have disappeared by now, and isolated instances, like the first one reported in this article, are due to the accidental admixture of salt with the food.

The toxic effect of salt appears to be due to its action on the muscles, so that the animal becomes unable to walk and, finally, to stand. Death is caused by asphyxia, due to loss of power in the respiratory muscles.

It is hoped that the publication of the above notes may serve to keep stock-owners, and especially poultry breeders and pig-raisers on their guard against the danger of too great an admixture of common salt in the food. —Agricultural Gazette of N. S. W.

BOARD OF AGRICULTURE.

On the Board MR. L. B. BOGAHALANDE, R.M., was nominated by HIS EXCELLENCY the President to fill the place of HULUGALLE ADIGAR whose retirement is regretted.

The Society deplores the loss of one of its most prominent and useful members by the death of MR. JOHN FERGUSON, who did much solid work on the Board during its early days, and will always be remembered as the founder of the TROPICAL AGRICULTURIST.

RATE OF SUBSCRIPTION.

According to the resolution passed at the Board meeting of the 3rd February, 1914, the Local subscription to the Society will from 1st January next be Rs. 10 and the Foreign subscription Rs. 15 (£1) per annum.

A BRIEF RETROSPECT.

The Society has now completed the first decade of its existence. It was founded by SIR HENRY BLAKE in 1904, and fostered by his successor SIR HENRY MCCALLUM.

Beginning with less than 100 members, its roll of subscribers has now swelled to 1,881.

Its first Secretary was MR. E. B. DENHAM, C.C.S., who carried out the preliminary organisation work in an admirable manner. He was succeeded in 1906 by MR. A. N. GALBRAITH, also of the Civil Service, who put in six months of solid work in extending the operations of the Society. He was followed by MR. T. A. CAREY, who acted for a short period of two months till the present Secretary took charge.

The correspondence of the office has increased enormously and the letters that come from all parts of the world, while giving much additional work to the staff, are also making that work more interesting. Many of these communications are of an encouraging nature, indicating as they do that the Society (chiefly through the medium of the TROPICAL AGRICULTURIST) has formed a link with residents in far distant lands, who frequently write not as strangers seeking information, but as co-workers in the common cause of agricultural development.

ACKNOWLEDGMENT.

In conclusion the Society would record its gratitude for the assistance it continues to receive from Government, and express its thanks to

NATIONAL FARM CO.

DEPOT

Diyatalawa Mills, Vauxhall Street, Slave Island.

Fowls **Rs. 18, 15, 10·50,** and **Rs. 9** per dozen. Ducks **Rs. 15,** Geese **Rs. 60,** Turkey cocks **Rs. 120,** Turkey-hens **Rs. 90** per dozen

Guinea fowls **Rs. 48,** Pigeons **Rs. 6,** Partridges **Rs. 6,** per dozen

Quails to order.

Pigs, Porkers, **cts. 35** per lb. live weight. Sucklings **Rs. 7·50, 5** and **3.**

Eggs, fresh, **75 cts.** per dozen.

Telephone 1087 and 285. **Telegrams: Wally, Colombo**

Usual discount to the TRADE.

HIS EXCELLENCY THE GOVERNOR for presiding over the meetings of the Board and in other ways giving practical proof of the interest he takes in all matters connected with the improvement of agriculture.

To the Director of Agriculture, in his capacity of Organising Vice-President, the Secretary is greatly beholden for much valuable advice.—C. A. S. REPORT.

PUBLICATIONS OF THE SOCIETY.

The TROPICAL AGRICULTURIST has during the past year been considerably improved and enlarged and, to judge from communications received from local and foreign correspondents, the change has been greatly appreciated and is calculated to attract more subscribers. The contributions by members of the Agricultural Department greatly enhance the value of the publication. MR. PETCH has been acting as Editor since May last.

That the GOVIKAM SANGARAWA (Sinhalese Agricultural Magazine) is materially helping to disseminate useful information in the villages will be gathered from the fact that no less than 3,300 copies are distributed monthly. I am much indebted to MR. N. WICKREMARATNE in the conduct of this publication.

The KAMAL THOLIL VELAKKAM (Tamil Agricultural Magazine) edited for the Society by MR. CHELLIAH H. COOKE is also gaining in popularity, though its cultivation is still comparatively small.

The latest issued leaflets treat on the following subjects :—

Sorghum as a Fodder Crop
Castor Oil Plant
Dry Farming
Plantain Disease

A report made by the Secretary on the All-India Agricultural Conference held at Coimbatore last December, and the lessons to be learnt therefrom, has been published.

In view of the subscription being raised from next year, it was decided to issue free to all subscribers the Year Book of the Society in an enlarged and improved form. This annual, which will be ready before the end of the year, is being contributed to by the staff of the Agricultural Department and others qualified to deal with specific subjects, and should therefore prove a useful handbook of condensed information on agricultural matters. It will also furnish much general information which is constantly in demand.

The Secretary's Junior Agricultural Reader (in Sinhalese) published at the Government Press is now ready and will be used in Government Schools. The Senior Agricultural Reader is just going through the press.—C. A. S. REPORT.

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Latest Monthly Prices Current.

	QUALITY.	Quotations.
ALOES, Socotrine cwt.	Fair to fine	40/ a 50/
Zanzibar & Hepatic ,,	Common to good	40/ a 70/
ARROWROOT (Natal) lb.	Fair to fine	5d
BEES' WAX cwt.		
Zanzibar Yellow ,,	Slightly drossy to fair	£7 10/ a £7 15/
East Indian, bleached ,,	Fair to good	£8 10/a £8 12/6
,, unbleached ,,	Dark to good genuine	£6 5/ a £7
Madagascar ,,	Dark to good palish	£7 15/ a £8 2 6
CAMPHOR, Japan lb.	Refined	1/7 a 1/8
China cwt.	Fair average quality	155/
CARDAMOMS, Tuticorin	Good to fine bold	5/9 a 6/
per lb.	Middling lean	4/8 a 5/4
Malabar, Tellicherry ,,	Good to fine bold	5/9 a 6/3
Calicut ,,	Brownish	3/9 a 5/3
Mangalore ,,	Med Brown to good bold	4/ a 6/4
Ceylon, Mysore ,,	Small fair to fine plump	4/ a 6/4
Malabar ,,	Fair to good	3/2 a 3/4
Seeds, E. I & Ceylon ,,	Fair to good	4/ a 4/3
Ceylon "Long Wild" ,,	Shelly to good	2/3 a 3/6 nom.
CASTOR OIL, Calcutta ,,	Good 2nds	3½d
CHILLIES, Zanzibar cwt.	Dull to fine bright	50/ a 60/
Japan ,,	Fair bright small	60/ a 70/
CINCHONA BARK.—lb.	Crown, Renewed	3⅜ d a 7 d
Ceylon	Org. Stem	2d a 6d
	Red Org. Stem	1¾ d a 4¼d
	Renewed	3d a 5¼d
	Root	1⅞d a 4d
CINNAMON, Ceylon 1sts.	Good to fine quill	1/3 a 1/9
per lb. 2nds.	,, ,,	1/2 a 1/7
3rds.	,, ,,	1/1 a 1/6
4ths.	,, ,,	1/ a 1/3
Chips.	Fair to fine bold	2d a 4d
CLOVES, Penang lb.	Dull to fine bright pkd.	1/ a 1/2
Amboyna ,,	Dull to fine	10d a 10½d
Zanzibar ,,	Fair and fine bright	5⅞d a 6¼d
Madagascar ,,	Fair	7d
Stems ,,	Fair	2d
COFFEE		
Ceylon Plantation cwt.	Medium to bold	Nominal
Liberian ,,	Fair to bold	63/ a 80/
COCOA, Ceylon Plant. ,,	Special Marks	81/ a 88/6
	Red to good	73/ a 80/6
Native Estate ,,	Ordinary to red	42/ a 68/
Java and Celebes ,,	Small to good red	30s a 93s
COLOMBO ROOT ,,	Middling to good	15/ a 22/6
CROTON SEEDS, sifted,,	Dull to fair	42/6 a 47/6
CUBEBS ,, ,,	Ord. stalky to good	130/ a 150/
GINGER, Bengal, rough ,,	Fair	19/
Calicut, Cut A ,,	Medium to fine bold	75/ a 85/
B & C ,,	Small and medium	35/ a 74/
Cochin, Rough ,,	Common to fine bold	22/6 a 27/
	Small and D's	20/
Japan ,,	Unsplit	20/
GUM AMMONIACUM ,,	Ord. Blocky to fair clean	40/s a 72s 6d
ANIMI, Zanzibar	Pale and amber, str. srts	£14 10/a £16 10/
,, ,, ,,	little red	£11 a £12
,,	Bean and Pea size ditto	70/ a £11
,,	Fair to good red sorts	£8 10/ a £10 10
,,	Med. and bold glassy sorts	£5 10/ a £7 5/
Madagascar ,,	Fair to good palish	£4 a £8
,, ,,	red	£4 a £7
ARABIC, E. I. & Aden ,,	Ordinary to good pale	26/ a 32/6
Turkey sorts ,,	,, ,,	37/ a 57/6
Ghatti ,,	Sorts to fine pale	17/ a 27/
Kurrachee ,,	Reddish to good pale	22/6 a 32/6 nom.
Madras ,,	Dark to fine pale	20/ a 30/ nom
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	£6 a £6 10/
	com. stony to good block	40s a £5
KINO lb.	Fair to fine bright	6d a 1/5
MYRRH, Aden sorts cwt.	Middling to good	57/6 a 67/6
Somali ,,	,, ,,	52s 6d a 55s
OLIBANUM, drop ,,	Good to fine white	45s a 50s
,,	Middling to fair	35s a 40s
pickings ,,	Low to good pale	15/ a 27/6
siftings ,,	Slightly foul to fine	18s a 25s
INDIA RUBBER lb.	Fine Para smoked sheets	2/4
	Crepe ordinary to fine	2/2¼
Ceylon, Straits, ,,	Fine Block	2/4¾
Malay Straits, etc. ,,	Scrap fair to fine	1/8 a 1/9
Assam ,,	Plantation	1/10
,,	Fair 11 to ord. red No. 1.	1/3 a 1/6
Rangoon ,,	,, ,, ,,	1/2 a 1/4

	QUALITY.	QUOTATIONS.
INDIA RUBBER lb.		
Borneo ,,	Common to good	9d a 1/3
Java ,,	Good to fine red	1/3 a 1/6
Penang ,,	Low white to prime red	9 d a 1/4
Mozambique ,,	Fair to fine red ball	1/9 a 2/1
,,	Sausage, fair to good	1/9 a 2
Nyassaland ,,	Fair to fine ball	1/9 a 2
Madagascar ,,	Fr. to fine pinky & white	1/4 a 1/6
,,	Majunga & blk coated	1/ a 1/2
,,	Niggers, low to good	6d a 1/6
New Guinea ,,	Ordinary to fine ball	1/4 a 1/7
INDIGO, E.I. Bengal ,,	Shipping mid to gd. violet	3s 3d a 3s 8d
,,	Consuming mid. to gd.	2s 9d a 3s 2d
,,	Ordinary to middling	2s 4d a 2s 9d
,,	Mid. to good Kurpah	1s 11d a 2s 5d
,,	Low to ordinary	1s 6d a 1s 9d
,,	Mid. to fine Madras	1/11 a 2/9
MACE, Bombay & Penang	Pale reddish to fine	2/4 a 2/6
per lb.	Ordinary to fair	2/ a 2/2
Java	,, ,, good pale	2/ 1 a 2/4
Bombay	Wild	1/
NUTMEGS,— lb.		
Singapore & Penang ,,	64's to 57's	9½d a 10½d
	80's	7½d
	110's	6½d
NUTS, ARECA cwt.	Ordinary to fair fresh	17/6 a 20/
NUX VOMICA, Cochin	Ordinary to good	13/6 a 15
per cwt. Bengal	,, ,,	12/
Madras	,, ,,	12/ a 13/
OIL OF ANISEED lb.	Fair merchantable	5/2
CASSIA ,,	According to analysis	2/8 a 2/11
LEMONGRASS oz.	Good flavour & colour	2¼d
NUTMEG ,,	Dingy to white	1½d a 1⅜d
CINNAMON ,,	Ordinary to fair sweet	4d a 1s 5d
CITRONELLE lb.	Bright & good flavour	1/6½
ORCHELLA WEED—cwt		
Ceylon ,,	Fair	10/6
Madagascar ,,	Fair	10/6
Zanzibar ,,	Fair	10/6
PEPPER—(Black) lb.		
Alleppy & Tellicherry	Fair	5d
Ceylon ,, ,,	Fair to fine bold heavy	5d a 5⅜d
Singapore ...	Fair	4⅝d
Acheen & W. C. Penang	Dull to fine	5d a 5½d
(White) Singapore ,,	Fair to fine	8½d a 8¾d
Siam ,,	Fair	8½d
Penang ,,	Fair	7⅜d
Muntok ,,	Fair	9d
RHUBARB, Shenzi ,,	Ordinary to good	2/ a 4/
Canton ,,	Ordinary to good	1/10 a 3/6
High Dried,,	Fair to fine flat	11d a 1/1
	Dark to fair round	9 d a 10d
SAGO, PEARL, large--cwt	Fair to fine	18/
medium ..	,, ,,	16/
small ..	,, ,,	13/ a 14/
Flour ..	Good pinky to white	10/ a 11/
SEEDLAC cwt.	Ordinary to gd. soluble	65/ a 75/
SENNA, Tinnevelly lb.	Good to fine bold green	5d a 8½d
	Fair greenish	3d a 4½d
	Common specky & small	1½ d a 2½d
SHELLS, M. o' PEARL—		
Egyptian cwt.	Small to bold	72/6 a £6
Bombay ,,	,, ,,	85/ a £6 10/
Mergui ,,	Chicken to bold	£8 12/6 a £145
Manilla ,,	Fair to good	£7 17/6 a 13 10
Banda ,,	Sorts	50/ nom.
Green Snail,,	Small to large	70/ a 85/
Japan Ear ,,	Trimmed selected small to bold	47/ a £5 15
TAMARINDS, Calcutta...	Mid to fine bl'k not stony	14/ a 15/
per cwt. Madras	Inferior to good	6/ a 10
TORTOISESHELL—		
Zanzibar & Bombay lb.	Small to bold	12/ a 26/
	Pickings	6/6 a 19/
TURMERIC, Bengal cwt.	Fair	12/ a 13/
Madras ,,	Finger fair to fine bold	14/ a 16/
Do. ,,	Bulbs ,, ,, [bright	12/ a 13/
Cochin ,,	Finger fair	13/ nom.
	Bulbs ,,	11/6 a 12/
VANILLOES— lb.		
Mauritius ... 1sts.	Gd. crystallized 3½a 8½ in.	9/6 a 15/
Madagascar ... 2nds.	Foxy & reddish 3½a ,,	9/ a 12/
Seychelles ... 3rds.	Lean and inferior	9/ a 9/6
VERMILLION ... lbs.	Fine, pure, bright	2/7
WAX, Japan, squares cwt.	Good white hard	47/6

Photo. by H. F. Macmillan.

Plot of Sudan Dura (Sorghum) at the Experiment Station, Peradeniya, with group of Agricultural Instructors on a visit of inspection with Officers of the Department of Agriculture. Reading from left: D. S. Corlett, Manager of Experiment Station; H. A. Deutrom, Asst. Manager; R. N. Lyne, Director of Agriculture; C. Drieberg, Supt. of Lowcountry Products and Secretary, Ceylon Agricultural Society.